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The Popular Science Monthly

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New York

# How to Buy a Home That Fits Your Pocket

By LEON MEADOW, Financial Editor

HENRY CRANE looked at his watch and yawned. "Don't you think we'd better call it an evening, Elizabeth? I can't remember the last time we talked, planned and argued so long about any one thing in our whole lives."

His wife smiled. "It's not every day," she replied, "that we decide to own our own home."

"Of course—but the deeper we go into this thing, the more planning we do, the more puzzled I get about this business of owning a home. The size and style of the house, the cost of upkeep, the amount we can afford to spend—all these questions are mysteries to me. That's why I think we can drop the discussion now, until I go over it all with someone who knows."

Her eyes sparkled with happiness. "Well, don't let it drop now, Henry. Be sure to talk it over with someone who does know, and then let's discuss it together again."

"Let me see . . . there's a chap downtown, Gordon's his name. That's it—Don Gordon. I've met him a few times. He's an architect who specializes in building small homes. Now that I think of it, Sid Nicholson once told me that Gordon planned his home for him and showed Sid how to finance it properly. If I remember correctly, this fellow Gordon has a reputation for that sort of thing. I'm going to drop in and see him tomorrow. I certainly ought to be able to learn something from him about home buying and building."

"I hope so," Elizabeth replied.

Henry was right. After spending an hour in Don Gordon's office he was beginning to understand how people went about buying a house. Like himself, most of them had a vague idea of what kind of house they wanted, and that they could pay toward it as much as they were now paying for rent—but that they knew very little about getting an absolutely satisfactory home. One that would not absorb too much of their income and yet, not be below their normal standard of living.

"We've found," said Gordon, "that, if a family devotes one sixth of its income to rent, it should be able to put one fourth of it toward buying and maintaining a home. This amount, when used for the latter purpose, will actually include both rent and savings. Why? Because we assume that on your first mortgage you will pay interest charges, the same as you now pay rent. Also, you will pay amortization charges each year—that is, a fixed payment that constantly reduces the principal of the mortgage. Every payment of this type is really a savings deposit—as, after a number of years, you will have reduced the principal debt entirely—and will own your home free and clear."

"Total annual payments on a house may require anywhere from 1/8th to 1/3rd of your income, depending of course upon

your particular circumstances."

"Yes," put in Henry, feeling a bit overwhelmed by all these facts and conditions. "I think I follow you so far. But what bothers me is how I decide how much I can afford to pay for my house and lot. Isn't that the logical base upon which all these other factors rest?"

"We're coming to that, Henry. But first there are other things to consider. For instance, there's the matter of cash. Regardless of how much your house costs and how much your income is, you have to be prepared to put up at least 20% of the total value of your house and lot in cash. No reliable bank or loan association is going to lend you more than 80%."

"That's true," admitted Henry. "I hadn't thought of that. But I'm fixed up pretty well as far as cash goes."

"Of course it's true," continued Gordon, "and you'll have to consider something else, too. The exact amount to be spent on your home can best be determined only by careful checking over the family's income, needs, and expenses. That means practical budgets covering all the varying and fixed items that come under those heads. But consider all that settled, for the time being. Now tell me, what's your income?"

"About \$5,000 a year. Why do you ask?"

"Just to get back to your own question of how much you can afford to spend on your house and lot. \$10,000 is top for you."

"How do you figure it?" interrupted Henry.

"It's not my estimate, Crane. Government research on home economics and financing, the long experience of building and loan associations—all have arrived at it. Under ordinary circumstances a family can afford to live in a house whose value, together with the lot, is twice as much as that family's income. That means you would have to put up at least \$2,000 in cash to buy the property and build a house worth \$10,000."

"And," Henry interrupted again, "if I can put up \$4,000—would that help?"

"Yes, considerably. The mortgage loan will be much easier to obtain and the burden of financing the whole thing will be much lighter for you." Gordon rose and after a few minutes at a filing cabinet across the room, he came back with a chart in his hand. "Here's a very interesting table on this subject," he said, sitting down and placing the sheet on his desk.

"This," said Gordon, "is part of a table which appeared in a bulletin published by the U. S. Dep't of Commerce. Perhaps a bit of explanation will give you the meaning of it more quickly."

"Fair enough," replied Henry, lighting a cigarette. "Let's have it all."

(Continued on page 6)





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# How to Buy a Home That Fits Your Pocket

(Continued from page 4)

Table Showing Income, Value of Home, and Typical Annual Expenses for House and Lot

1. Value of house and lot	\$7,000	\$8,000	\$9,000	\$10,000
2. Annual income to	2,800	3,300	3,600	4,000
3. 1st cash payment, 40% of value	2,800	3,200	3,600	4,000
4. Amount of loan	4,200	4,800	5,400	6,000
5. Int. & amortization (12% of loan)	504	576	648	720
6. Estimated taxes, interest, and upkeep	300	330	360	400
7. Tot. Annual Exp.	704	806	1,008	1,120
8. Savings inc. in above total, (1st year)	212	294	374	400
9. Savings comparable with rent (1st year)	122	204	284	280

"Item 1," began his friend, "is the value of your house and lot. At the top of the last column on the right is the figure, \$10,000—the sum we've decided you can afford to spend. This is dependent on Item 2, your annual income and, as you can see, directly beneath the \$10,000 are the figures \$4,000 to \$6,000. Notice this, Henry: the figures for the various income groups overlap each other all along the row. This was done because no two families with the same income ever spend the same amount for their homes. Size of family, preference of location and other varying conditions are the principal causes for this difference. But look how this table justifies my previous statement about the house and lot being valued at twice as much as the annual income. The average income between \$4,000 and \$6,000 is obviously \$5,000—and the house and lot in this case are valued at \$10,000. So that's that."

"Right you are, Don. A great light is dawning." "Then you better go cautiously. More often than not people are blinded by these so-called 'great lights' and lose sight of everything else. Item 3 is self-explanatory. Your first cash payment is 40% of the total value—or \$4,000. Item 4 is also obvious; the balance, or amount to be borrowed, is \$6,000."

"That brings us to Item 5—interest and amortization on the loan. Apparently these figures were taken from the conditions laid down by building and loan associations. 9% goes to interest and 6% to reduction of the principal. Incidentally, if these figures are extended I think the loan can be paid off entirely in less than 12 years."

"One minute Don, that doesn't sound right to me. Your annual payment for Item 5 is \$720. Half of that, or \$360, goes to reduction of the mortgage. Then, in twelve years about \$4,000 will have been paid off. So how do you figure that the whole loan will be cleared?"

"I was coming to that. Most building and loan associations arrange the loan so that you only pay interest on the net principal. In other words, after the first payment of \$720—the \$6,000 has been reduced by \$360 to \$5,640. Next year you still pay a total of \$720 on the \$6,000, but out of that \$720 is taken interest on only \$5,640 and the rest is applied to reducing the loan. So that, every year, as your principal decreases, your interest charges also diminish and a larger balance of the \$720 goes to amortizing the principal. In about 119 months, I believe, the whole debt has been cleared."

"Now, here's Item 6—estimated taxes, insurance and upkeep. Well, local tax rates usually run from 1% to 1½% of the market value of your property—insurance to about ½% of 1% of the value of house alone—and upkeep is generally estimated at 1% of the value of the house. Of course, all these percentages may vary but, ordinarily, they're fairly representative of the average for these expenses. In fact, \$400 for this item is well above the average figure, so that you need not be afraid of underestimation. Item 7 is just the addition of Items 5 and 6, not including such extra expenses as water, fuel, light, phone, special assessments, etc. The majority of people when paying for a home spend between 18 and 21% of their incomes for Item 7, plus these additional expenses, according to Department of Commerce figures. In your case, the \$1,120 for this item is about 20% of your income—so that there is still plenty of lee-way."

"That brings us to Item 8—the savings included in the total for Item 7, for the first year. You remember I said that half of that \$720 went to reduction of the loan and that it could be considered as savings. This accounts for the figure of \$360 under item 8."

"Now for Item 9. The \$760 in this column is the difference between Items 7 and 8—or the difference between the total expenses for the house the first year, and the amount of savings represented by the reduction of the mortgage loan that same year. The balance is comparable with rent expenses. But as you know, rent expenses are fixed charges; whereas

Item 9 will grow smaller each year.

"It is rather complicated," Don continued. "You see, Item 8, your savings, or the reduction of the loan, grows bigger each year, as I already explained. Naturally, the larger this gets, the less there will be left when subtracted from the total annual expenses in Item 7. In other words, if Item 8 should be \$400 next year—and you subtract this from the \$1,120 in Item 7—there would only be \$720. So it all comes down to this: now Item 9, the net annual expenses for the house is about as much as your present apartment rent. Each year following it will be even less. After 12 years, when the mortgage is paid off, there will be left only the expenses of taxes, insurance and upkeep—\$400 according to Item 6. This is less than half your present rental expenses."

"Now do you know more than you first did?" "No question about that, Don. You've certainly been a great help. One thing more, the property—how much of the \$10,000 goes to that item?"

"That's not hard," Gordon replied. "Where no improvements have been made in the locality, you should spend from 1 to 1½% of the total for your lot. Where they have been made, then 20% or \$2,000 is fair. Never more than 25%, at any rate. Before you buy anything or make any agreements, have the lot appraised by a disinterested and expert third party. Now, when you apply to your bank or loan association, under ordinary conditions they should be willing to lend you up to 80% of the total value of house and lot. If, as in your case, you apply for a loan of 60%—with the intention of building on the property—and it is refused, then watch your step. It generally means that the price of the property is too high. Things like this prove the wisdom of checking up first and buying later. Will you excuse me now, Henry? I must run along and keep an appointment uptown."

"Of course, Don—I've kept you long enough as it is. If you're as good an architect as you are a home financing adviser, I know who's going to design my house for me."

Gordon laughed. "And if your home is designed as well as it can be financed, your architect, no matter who he is, will have done a good job."

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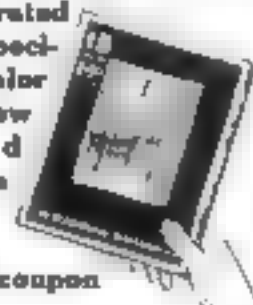
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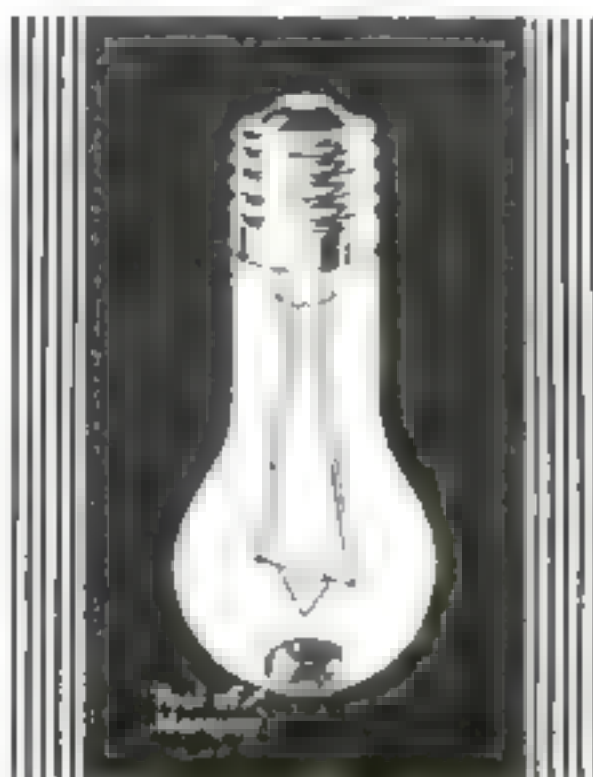
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SINCE the dawn of civilization primitive men and animals instinctively turn to sunlight for its beneficence. What modern science knows, the ancients only sensed. The Greeks and the Romans had their Phoebus Apollo, The Brahmins of India paid homage to the sun under a variety of forms. So did many Buddhist sects. The Emperors of China and Japan claimed to be the descendants of the Sun God. Virtually, all the Indians of North and South America were sun worshippers, the most fanatic in this respect being also the most highly civilized—the Incas and the Mayas.

For countless centuries these people turned gratefully to the sun, worshipping its benevolence. Belief in the goodness of sunshine is something that is born in every one of us, a heritage from those far off days when the cave man selected his residence to face the sun and the Romans built lavish solariums better to enjoy the health-giving energy of sunlight.

Unfortunately for most of us, as physicians and scientists realize, the sunshine that our forefathers knew, a kindly beneficent season out in the open under a cloudless sky, free from smoke and dust and dirt, is gone. Economic necessity has made of us a nation of sun dodgers, hiding away in closely packed buildings in the daytime, working and playing behind glass that screens out the ultra-violet rays of sunshine just as surely as the window shades screen out the visible rays of the sun's light. We bundle up our bodies. We ride in subways and street cars and automobiles, almost totally cut off from the sunshine which our forefathers enjoyed as a matter of course. Even when we get out-of-doors in our cities, smoke and dirt cloud the air and rob the sunshine of more than three-quarters of its active health-giving rays. And then winter comes; and the sunlight loses most of its health value. Lucky, indeed, it is for us that we know more about the sun than the Romans did—than even



*In buying sunlight for your home this winter the important thing to watch for is the source of the light. Be sure the fixture you buy is equipped with a General Electric Sunlight Mazda Lamp as pictured. Be certain the bulb offered you contains the pool of free mercury, a gift no substitute for General Electric Sunlight and the safety, simplicity and efficiency provided for you by Mazda research.*

modern science knew about it—perhaps twenty-five years ago. Lucky, indeed, it is that science has presented us with a new means of compensating our bodies for the losses caused by our economic necessities.

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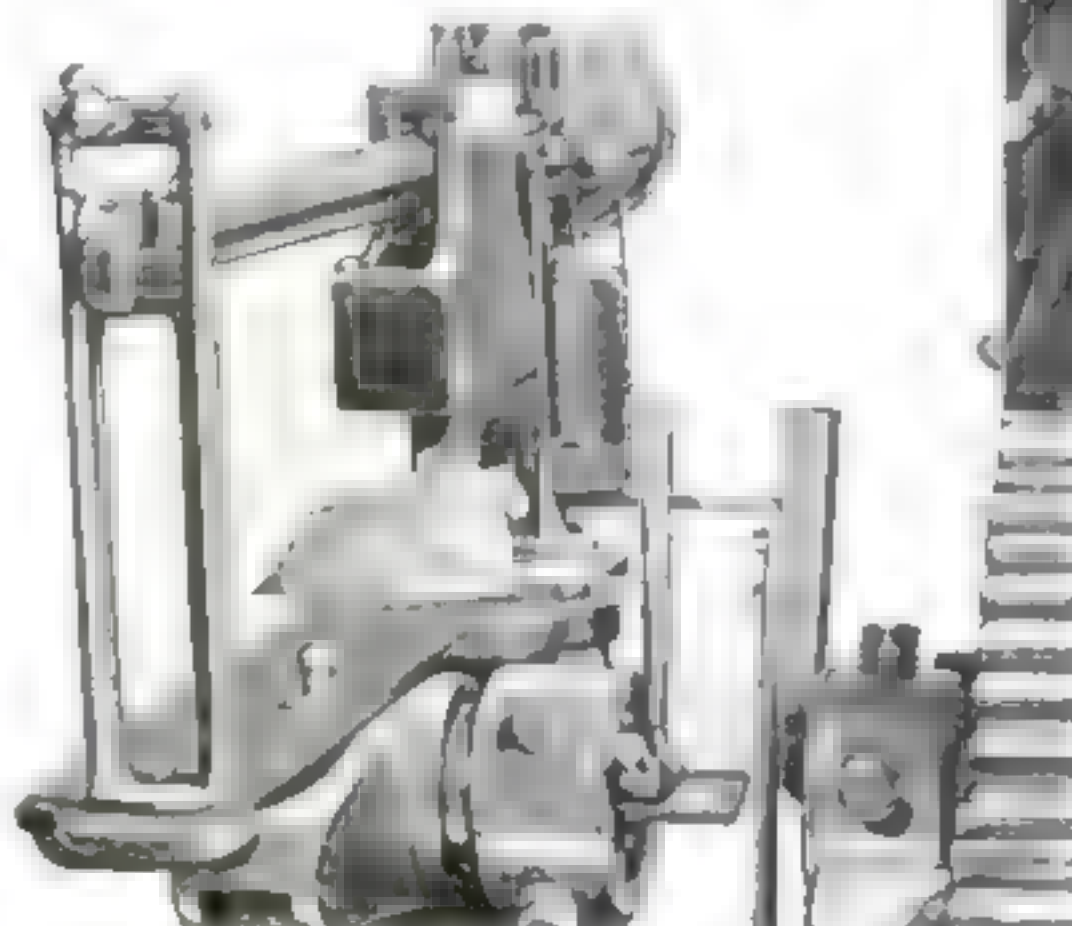
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This torsion machine is used in testing the strength of claws and strength of handles of hammers. Loads up to 3,000 inch-pounds may be applied.



Here are four specimens that have undergone test in the machine illustrated at the left.

pressure is applied until the handle breaks. A dial records the inch-pounds of pressure. To be approved by Popular Science Institute a hammer handle has to withstand a minimum pressure greater than can be exerted by a man.

In the illustration will be seen four specimens of a particular make of hammer after they had gone through this handle test. These hammers stood 1,725, 1,850, 2,325 and 1,975 inch-pounds, respectively, before they ultimately gave way.

The face and wedge test to which hammers are subjected consists of 10,000 blows in a striking machine. The purpose of this test is to see if the face is affected (whether the steel is too soft or too hard) and also to determine whether the head is properly wedged.

To test the hardness of the various parts of the hammer head, two machines are used. One is a scleroscope, in which a hardened plunger strikes the part to be tested. The plunger rebound is measured and by an engineering formula shows the hardness of the steel used. Another test to determine the hardness of a hammer head is made with the Brinell testing machine. In this test a hardened steel ball is forced into the metal. The circumference of the tiny hole made by the hardened steel ball is then measured and again an engineering formula is used to determine the precise hardness of the steel.

CONSIDERING how alike hammers are in appearance, it is surprising how their reactions differ under these tests. They explain what many buyers find hard to understand, that is, why one hammer will cost \$1.50 and another but fifty cents when one looks only slightly better. The dollar's difference usually lies in the fact that the \$1.50 hammer will stand up under hardest usage by a carpenter for a lifetime while the cheaper hammer is likely to break under the first hard blow.

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# You Should Choose Hammer Carefully

By COLLINS P. BLISS

Dean, College of Engineering, N. Y. University; Director, Popular Science Institute

IT LOOKS as though one hammer ought to be pretty much like another but, as a matter of fact, there is actually room for much difference, though this difference is not readily apparent to the average buyer.

The variation in hammer quality lies not only in the hammer head but in the handle itself and in how it is attached to the head. The best made handle may be worthless when wrongly inserted and this is a shortcoming that Popular Science Institute has found in many hammers that it has tested.

In the first place, the hole in the head must taper both ways from the midpoint and have the greatest taper on the head end of the opening. There must be a shoulder on the handle, so when the handle is tapped at the end, the head will come down firmly on the shoulder and not split slivers off the handle. It is better to have considerable play in the hole of the hammer head and use wedges to spread the wood rather than have too narrow and straight a hole, which tends to let the head work down on the handle. The face of the hammer head should be hard at the center and softer at the edges; if not, chipping of the edges results.

Besides proper insertion of the handle the following points are important in determining the merit of a hammer.

1. The strength of the claws for nail pulling.
2. The strength of the handle.
3. The hardness of the hammer head.

When a hammer is being tested by Popular Science Institute to determine the strength of jaws for nail pulling, the method used is to place a steel plate about one half inch thick and four inches wide in the chuck of a torsion machine. Holes then are drilled in this plate for various sized nails, and nails exactly fitting each hole are forced through, leaving enough for the claw of the hammer to grip the head of the nail.

THE shank of the nail is turned flat against the underside of the plate and a steel clamp holds it against the plate. The twisting head of the testing machine then revolves and the lever extension puts a gradually increasing load on the handle bending it as shown in the photograph at the top of the page. If it is a good hammer, it will pull out the nails or strip the head before the claws give way.

The next test is to establish the strength of the wood used in the handle, and to do this a steel bolt is substituted for the nail with a nut holding it so the hammer cannot pull it out without stripping either the threads or the head. The testing machine is then set in motion and







# Our Readers Say

## Here's a Kind Word for the Lowly Auto

I THINK J. S., St. Louis, Mo., is not as serious as he pretends. Surely one can show that the automobile has done more good than harm. Where would the United States be today if it were not for the auto or where would the world as a whole stand? The auto has helped solve the problem of the farmer and has opened up the remotest spot to progress and development. It has served as a stepping stone for other inventions as well. Yes, it causes deaths unnecessarily but that is the price we must pay for it. Instead of blaming the auto, I think the driver is mostly responsible. Am I not right? I hope he'll consider a little more carefully what he has to say. P. S. Now isn't that very rude of me to neglect my most important reason for writing, namely to congratulate you on your magazine? The saying, "one will stand out" is true because on top of the pile you always find POPULAR SCIENCE MONTHLY ready and striving to climb higher.—R. L. H., West Point, Ga.



## Patent Office Folks Human, After All

THE "NEW YORKER" and other Patent Office loudspeakers. The Patent Office is doing you a great favor to put your stuff on record. Ninety percent of the patented things are junk, that's why they don't get over. How long would you want to look through the freak ideas now on record? How about a good patent attorney next time? I have some black eyes from the Patent Office myself. In one case it looks like a man's religion got in the way of my pet idea. Give the Patent Office credit for this one. Patent No. 1763415 Ap. filed Jan. 9th, 1930, patented June 10th, 1930. The Patent Office folks are human. Better work with them in a cooperative way. I have nothing patented yet that any one wants. How many have you?—E. B., Pine Bluff, Ark.

## Can You Help Bill and John Dig?

I HAVE been a consistent reader of POPULAR SCIENCE MONTHLY for the past five years and have had a lot of fun working its problems. I have not found many as yet that have stuck me but here's one for you to concentrate on. John and Bill take a contract to dig a ditch 100 feet long for \$1.00. One end of the ditch is hard digging and one end is soft digging, so Bill says he will do the hard end for \$1.25 a foot if John will dig his end, which is soft, for seventy-five cents a foot. Therefore if each digs one foot they will draw \$2.00 for the two feet. That will be \$1.00 a foot will it not? The problem is how much of the ditch does each man have to dig to get his \$1.00.—S. J. T., Oxfordville, Wis.

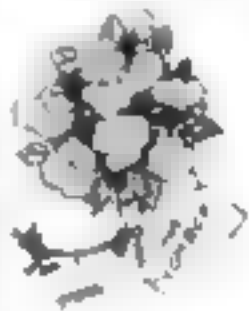


## Approved by the Wisdom of Age

I THANK you for the beautiful magazine you have built up and if I were a young man I should certainly continue with you. On the last day of this year I was eighty-five years old and your monthly which is indeed very fine will have to be given up, along with several other monthlies and weeklies, because of the weight of years and the infirmities of the flesh. About all my reading now is in the Old Book which tells of the "house not made with hands, eternal in the heavens." May God bless and prosper you.—J. C. V., Seattle, Wash.

## Don't Blush, Tomboy: There's a String to It

LET THE fellows give a couple of cheers for "Tomboy," of Fort Myers, Fla. It makes me wish I could read POPULAR SCIENCE MONTHLY this would be a more useful generation. It is certainly a relief to discover a femme, these days, who knows the difference between a starter and a stuffing box, and who knows that a spark plug is something besides the name of a commodity horse. But don't get me wrong. I am not one of the advocates of the woman-taxi-driver idea, and I still cling to the notion that a woman's place is in the home. However, a little working knowledge of what makes the wheels go 'round in that home and outside, is really a help. I think. Your magazine is great, and I am glad it is so popular. There is a big gap in the home mechanic's field. I like the boat construction articles, and would like to see more of them. An outboard constructed from your plans last year turned out fine, and we are now ready for something a little tougher. Why not a sailing dinghy, or something of the kind? They are plenty of fun to sail, and can easily be equipped with an outboard if desired. How about it? Something makes me feel perfectly sure that there are an awful lot of your readers, who constantly use your plans, who would be glad to get a chance at the dinghy.—G. T., Washington, D. C.



## Admits that 700 Miles an Hour Seems Fast

ABOUT the first thing I saw in the January number of POPULAR SCIENCE MONTHLY was the new German "mystery" plane. In my opinion the mystery is for the builders to attain the anticipated speed of 700 miles an hour. The fastest speed to date is only a little over half of that. The English plane that made this speed was streamlined to the utmost and had the added factor of comparatively dense air for the propeller to grip. While the rarefied air at 35,000 feet cuts down the plane's resistance, it seems to me the propellers are going to have a tough

time pulling that big plane along at even the present high rate of speed if they have nothing to grip. I am anxious for news of what that doubt is there ever are any. I hope you have a great magazine. H. I. Ocean City, N. J.

## Here's An Idea for a Bike That Flies

YOUR article in a recent issue about the winged bicycle seems to me a very fine thing for giving young boys practical training and experience with aeronautics. But while reading it, my mind wandered to the idea of gearing a small propeller to the rear wheel, and in this way it might be possible to wear some distance with the wheels off the ground. While I have no intention of tinkering with anything of this kind, I would like to see the idea put into the hands of the parties who are working with the winged bike.—J. K., San Luis Obispo, Calif.



## Student of Occult Finds No Tricks

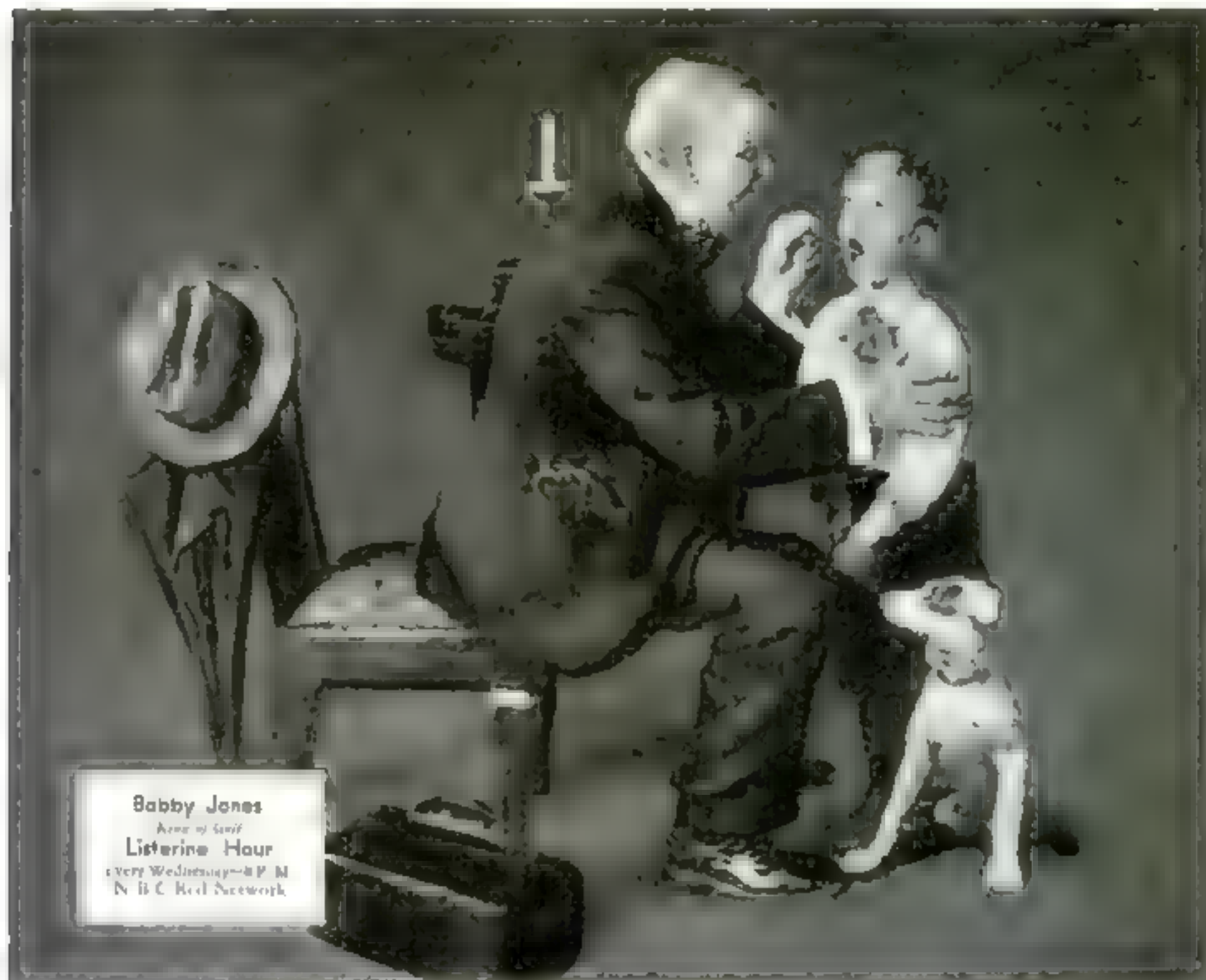
JUST a word in reference to the article in your January number on "Secrets of the Fortune Telling Racket," by Michel Blak. It has been my pleasure to meet personally several people, of a type usually quite modest and hence unknown to the general public, who do have what might be called supernatural powers of perception, and to all fairness to them, and to all others concerned, I hereby challenge anyone to explain just what "tricks" are used by them to obtain the "readings" they are capable of revealing. Why not let your readers hear both sides of the story and let them decide for themselves whether or not everything is deception and fraud in the realms of occultism?—D. B. H., Houston, Texas.

## High Altitude Flight Is All Figured Out

I THOROUGHLY enjoy your articles on aviation, especially those on the future of this great means of transportation. Some time ago I noticed an article in POPULAR SCIENCE MONTHLY saying a plane could reach a very high speed if it were about fourteen miles high, if it were not for the fact that the atmosphere at that elevation is too thin for the modern propeller. Isn't it possible for the plane to have a gear on the propeller so that it can be speeded up as the air grows thin? Also to cut down friction couldn't a plane have a propeller much too large for its motor and then have







## "Stay home—and gargle with Listerine every 2 hours"

**T**HAT is what your doctor would probably tell you to do if you had an ordinary cold or simple sore throat. Combined with rest and warmth, it is an excellent treatment. Over and over again this has been proved in the past 50 years.

These ailments are caused by germs multiplying by millions in the mouth and throat. They are continually striving to overcome the forces of health in your body. They often succeed when body resistance is lowered by such things as wet feet, fatigue, lack of exercise, exposure to draughts, cold, sudden changes of temperature.

Their names are Streptococcus Hemolyticus (the streptococcus germ), Staphylococcus Aureus (pus), and Bacillus Influenzar.

### *Reduces mouth germs 98%*

And undiluted Listerine, used as a gargle, kills these germs—all germs—almost instantly. In 15 seconds to be exact—the fastest time science has been able to measure accurately.

Repeated tests, similar to those employed at great universities, show that it actually reduces the bacteria on the surfaces of the mouth 98%. And at the same time soothes and heals inflamed membrane.

### *As a precaution*

As a precaution against colds and irritated throat, gargle with undiluted Listerine every morning

and every night. And when these have actually gained a foothold, increase the gargle to once every 2 hours, meanwhile consulting your physician.

The wonderful thing about Listerine is that while a potent germicide, it is at the same time non-poisonous, safe to use, pleasant to taste, and healing to tissue. Keep Listerine in home and office and carry it when you travel. At the first symptom of trouble use it undiluted to get full germicidal effect. Lambert Pharmaceutical Company, St. Louis, Mo., U. S. A.



**KILLS 200,000,000 GERMS IN 15 SECONDS—HEALS TISSUE**



the motor geared down for use when taking off? When it reached a certain altitude the speed could be increased.—E. W. K., Blackwell, Texas

### Has Found a Cure for Hay-wire Blues

WE WORTH all go nuts if it weren't for POPULAR SCIENCE MONTHLY, which affords us good, high-class reading matter. The papers have all gone hay-wire over the political questions, murders, bank robberies, and other scandals. No articles compare with the inspiring ones in your magazine. POPULAR SCIENCE MONTHLY gives the poor-strained newspaper reader a chance to relax and recuperate only once a month. With the distressing increase of newspaper bunk, it looks as though you will have to send out extra editions to keep the world from going bugs.—R. M. C., Houston, Kan.



### Avoid a Headache and Use an Axe

LET someone explain how a saw cuts. For example. Let us assume we are cutting a thin piece of wood, one sixteenth inch thick, on a hand saw. The first tooth that happens to strike it cuts down a thin shaving, just like a chisel then we push the wood toward the saw into the space between the teeth until the next tooth comes and strikes it in the same way, cutting off another shaving; simple, isn't it? But now let us assume we have a piece of lumber so thick that two or more teeth strike it at the same time. We would naturally think that the first tooth that strikes the thick piece would cut down a shaving as before, but there is no such first tooth, as several teeth must strike at the very same time, each tooth exactly following the path of the preceding one. What chance do we have to push the material into the saw? Or in other words, how can the teeth take a shaving?—F. H. L., Ames, Iowa.

### From Cover to Cover Forever and Ever

I LIKE every department in your magazine and hope you will not have to cut out any of them to make room for material that apparently some selfish subscribers are calling for. I especially like "Our Readers Say" and—well, all the others. My subscription soon expires, but rest assured that it will be renewed each year as long as I live so please don't stop sending POPULAR SCIENCE MONTHLY to me until some one notifies you I have left this old earth. Your series on the Patent Office was a wow!—P. E. M., Saranac Lake, N. Y.

### Use the Scissors If You Don't Like It

I HAVE been a regular reader of your magazine for several years and I can truthfully say that I have found no periodical equal to yours. The cranks who send their knock to "Our Readers Say" ought to get a good pair of shears and cut out the parts of POPULAR SCIENCE MONTHLY that they don't care for. But for me, give me all of it. Out here it's hard to get too much of a thoroughly good thing. E. P., Broomington, I.



### Helicopter Doubters, Please Take Notice

IN YOUR "Our Readers Say" D. A. of Idaho has probably made a lot think of the helicopter. Not being in the know of the helicopter business I don't claim to be able to give the answer, but I think the following sounds fairly logical. Why should the whole fuselage of the helicopter, with its large area of resistance, especially that of the broadside of the rudder, revolve when the knifelike blades of the revolving wings offer so little resistance? The forward pull of the propeller ought to overcome this tendency of twirling, even though revolving at decreased speeds.—S. A. D., St. Petersburg, Fla.

### Ice Age Swings from Pole to Pole

IN THE article on the Ice Age, by Charles F. Talbot, it is said that we are still in the Ice Age, but at the beginning of a minimum northern glacial winter. We are now at a period of minimum eccentricity of the earth's orbit, the sun being as nearly as possible equidistant from all points of the orbit. So there can only be a minimum glacial winter and a minimum glacial summer. Due to the precession of the equinoxes, the earth changes its position in its orbit till in about 6,000 years it makes the complete circle. The period from the maximum to maximum great glacial period is about 250,000 years. Thus every 250,000 years we have a great glacial winter and while we are enjoying the cool spell our friends in the southern hemisphere are enjoying a great glacial summer. During a northern great glacial summer, the North Polar basin would have only a lake in the lowest part, and animals and peoples would thrive there. With the coming of winter, they would be forced south. I hope I have made plain the fact that there was no universal Ice Age but ice periods alternately covering the northern and southern hemispheres.—I. B. W., Alhambra, Calif.



### Where in the World Did the Kick Go?

HIER'S a new problem your readers might think about—if any. A coiled-up metal spring is placed in acid. The acid dissolves the metal. What happened to the energy in the spring?—G. M., Martinez, Calif.

### Calls Montgomery Father of Aviation

WHILE in Europe I read your article about John Montgomery, who is, I believe, the real father of aviation. I know so much about his history and have spoken with so many who remember his early attempts that I often resented the silence that hung around his name and memory. I congratulate you on publishing such a fine article and thus rendering to John Montgomery some of the tribute he deserves.—R. K., San Francisco

### North Carolina Really Has Flexible Stone

IN POPULAR SCIENCE MONTHLY recently there appeared an article entitled "Exhibit Brazil's Flexible Stone." Flexible sandstone or itacolomite is to be found in North Carolina. Something like forty years ago I got specimens from a deposit in that state; some of these samples were upward of a foot long. Years ago itacolomite was used in the manu-

facture of sandsoap, the itacolomite forming the abrasive. I recall distinctly where I found this deposit and would have no great difficulty in locating it, if any one is interested.—E. M. W., Los Angeles, Calif.

### Cry for Chemistry from the Far West

MAY I join with O. L. C. of Seattle, R. H. B. of Philadelphia, and J. D. F. of Carlisle, Pa., in requesting more articles on chemistry? I was particularly interested in the idea of chemical problems. To my knowledge this would be an original feature of your magazine. Chemical problems are, as a rule, interesting without being unnecessarily technical. They are also unique in the opportunity they offer for ingenious applications of commonly known facts. POPULAR SCIENCE MONTHLY is very enjoyable (especially to the friends who borrow my copy).—F. W. N., Spokane, Wash.



### Short and Not What You'd Call—Sweet

YOU ought to change the name of your publication to Popular Tinkers and Model Makers Monthly. It's good for that but not much science in it.—O. O., Goshen, Ind.

### Orders His Bracer to Follow Him South

WOULD I be asking too much to have you send my magazine down here for four months? My health needed this move, so what do you say? You know I ordered some other magazines to stay up there, but POPULAR SCIENCE MONTHLY I've got to have for a bracer.—A. K., St. Petersburg, Fla.

### Ignore the Croakers and Stay as Is

W. J. M., Macon, Ga., is evidently only a beginner in driving. Well, we must be somewhat lenient with the beginner, for we were all that at one time. However, for a great many of us, when we were beginners, there was little traffic on the highways. But he is all wet when he hits at the speed of the buses. Their equipment is always in a nearly perfect shape as good mechanics can keep it, and at the end of every run of several hundred miles they are thoroughly gone over and every part tested and the brakes inspected. Heavy as they are, and fast as they travel, the buses are not the menace on highways that ordinary cars are. I wish to congratulate the makers of POPULAR SCIENCE MONTHLY on the fine appearance of the magazine since the change in covers. You now have a cover that does credit to a fine interior. Pay no attention to the croakers.—E. B. M., Vratura, Calif.

### All the Army Out of Step but Him

I WANT to tell you that I am just scientific enough not to swallow all the halibutings of these self-exalted, so-called scientists. Their idiotic, wild guessing is laughable in the extreme. I don't want your magazine. I love truth but I don't go much on guesswork.—H. P., Black Eddy, Pa.







KEEPS THE HUM OUT  
OF THE TALKIES!

## *Greatest advance since TALKIES came !!!*

Soon you will hear talking pictures made with all the humming and scratching noises barred out. A revolutionary new process, Noiseless Recording, gives you every word and note in its natural tones—clean cut and true to life.

Western Electric proclaims Noiseless Recording far and away the greatest advance since it first made talking pictures possible four years ago.

Ever since, its engineers have kept on their research, seeking perfection in the application of sound to making and showing pictures. They have introduced many improvements, and now the most important of all — Noiseless Recording.

Leading producers, quick to apply this latest gift of science, are now making pictures which will thrill you with their undreamed-of realism. You can hear them to best advantage, of course, in theaters equipped with the Western Electric Sound System.

# *Western Electric*

NEW PROCESS

# *Noiseless Recording* *for Talking Pictures...*



Makers of your Bell Telephone and leaders in the development of sound transmission.





## Make it out of PRESDWOOD ...and make it better

**R**ADIO cabinets, automobile bodies, case backs, refrigerator cabinets, store counters, partitions and panels, speed boat hulls, waste baskets, trays, magazine racks, toys, doll houses—hundreds of similar articles—now are being made of Masonite Presdwood ... made better, more durable, and with decided economy.

Manufacturers who guard the appearance of their products, and who are watchful of costs, have taken kindly to Presdwood. So, too, have home mechanics. They value this versatile all-wood board for its easy workability, its economy, its adaptability. Presdwood cuts and saws cleanly, will not crack or splinter, and can be nailed right up to the edge without splitting.

Dense and strong, Presdwood resists moisture; it will not warp. It is ideal material for concrete forms; facilitates construction and produces smoother, better concrete. Smooth and grainless, Presdwood is attractive in its original state, and it takes finish beautifully. Panels of Presdwood make lovely interiors.

Manufacturer, contractor or handy-man-around-the house, you'll find much to interest you in the Presdwood booklet, listing eighty of its uses, and telling how it is made and how best to apply finishes. The booklet is yours for the asking. Just send the coupon.

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STRUCTURAL INSULATION • INSULATING LATH  
PRESDWOOD • QUARTERBOARD

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### Warmer Homes; Smaller Fuel Bills with Masonite Structural Insulation

Resisting winter's piercing cold and moisture, Masonite Structural Insulation in roofs and floors and walls assures warmer homes—at a saving of a third or more in fuel bills. Masonite works with the seasons; keeps heat where it belongs—inside in winter, outside in summer. Also makes homes quieter. Check coupon and get the interesting Masonite booklet.

### Send for Free Booklet

Mail the coupon today. It will bring you the interesting story of Presdwood.

Masonite Corporation, Dept. D-3  
111 W. Washington St., Chicago, Ill.

Please send your free illustrated booklet that describes Masonite Presdwood and its many uses.

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When this typograph machine came in thousands of hand printers were put out of work but increased publishing business brought them back and added thousands of new ones.

women, and that labor-saving devices has not changed.

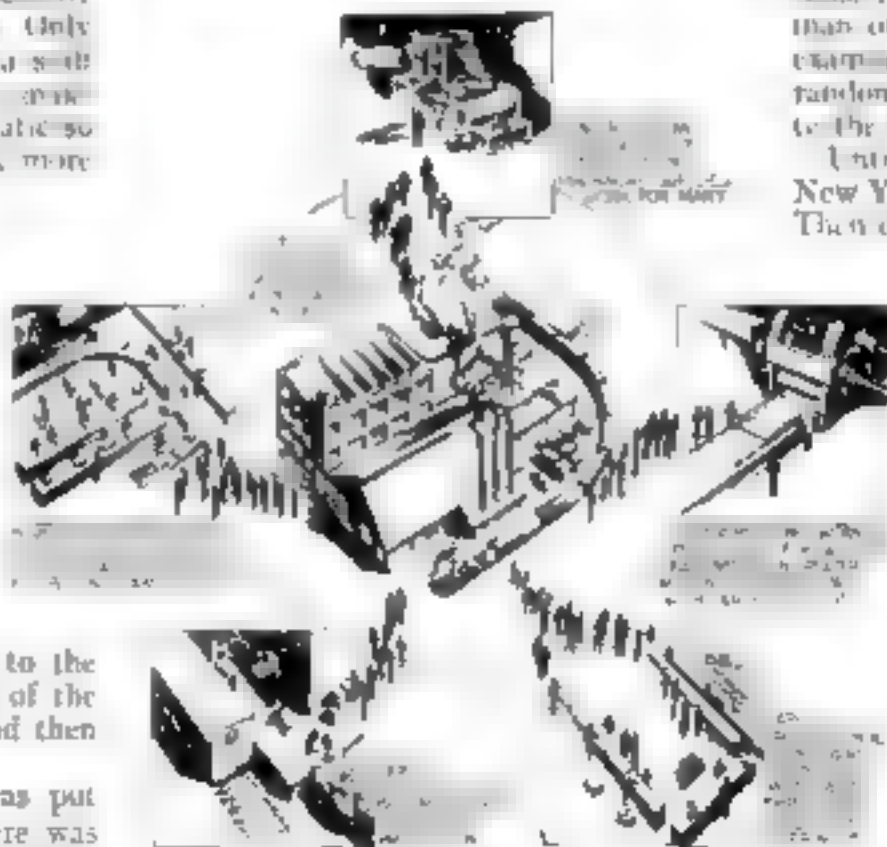
Time and again the Smith plant is cited as a horrible example by those who believe that machines throw men out of work. Fifteen hundred men displaced by machinery in this one enterprise. Only 200 mechanics left at work while a staff of more than 600 engineers try to make machinery even more nearly automatic so that more jobs can be taken from more men!

**ON THE** face of it this looks like a final argument against the machine and justifies you in branding it as a man eater. But the fact is not a single man has lost his job in the Smith plant because of the new automatic machinery. On the contrary it has given work to many more.

Eager to know if these statements given out as facts were really true I put the problem up to the A. O. Smith Company. An official of the company told me they are true and then gave me this explanation:

"The automatic frame plant was put in operation at a time when there was a large increase in the demand for frames. We therefore, kept all of the men in the

old hand plant and employed new men for the automatic plant. We still operate the old plant for the small runs and use the automatic plant for the large quantity production runs."



This diagram tells the story of the labor-saving machine and why it does not keep men out of work.

That's part of the story. The rest, still more surprising, shows how even more men were put to work. Research by the same staff of 600 engineers that seemed bent on kicking men out of jobs led to a new electric arc welding process which, applied to couplings for joints in oil well pipes, has supplied jobs, directly and indirectly, for more than 5,000 men. In short, the Smith research gang robbed not one man of work but literally put thousands of new ones on the pay roll.

Look, the new machines turn out thirty-two couplings ranging from four to twenty inches in diameter, every day in the plant. In two months, last spring, orders for 10 miles of pipe in the lay-out which an army of men is still

working on. If the unreamed-of low pressure gas now comes from a Texas to Oklahoma, Amarillo, Tex., to Denver, from the Monroe field of Louisiana to St. Louis, Mo., 431 miles, from Los Angeles, Calif., to San Francisco, 190 miles (P. S. M., Aug. 30,

1935) has seemed like a wild fairy tale. I again appealed to the Smith Company for an explanation.

"That's right," he said. "When the new plant was ready for operation, additional men were employed. Therefore, we have a great many more employees on our pay roll today than before the automatic frame plant was started and before we began the ream of pipe."

The Smith plant is only one of many in which labor-saving devices have made men, increased the pay roll, and put no man out of work. For instance, here are examples not hand-picked but chosen at random and anyone so inclined can add to the list without the least trouble.

Until a few years ago all packing in a New York food factory was done by hand. Then came a "stacker" that did the packing mechanically, and with its installation more than 1,000 men lost their jobs. But the new packing method so speeded up distribution that all of the old men were taken back and put to work on finishing and labeling.

A New England screw factory installed new automatic screw makers, a number of which could be cared for by one man. Out of 600 men previously employed, 200 were dropped from the pay roll. But the new machines increased production, an official of the company told me lowered prices and so stimulated the demand that every one of the



old employees had to be taken back, pack, count, and weigh.

In the case of the Smith plant machines made new jobs. The other labor-saving devices were responsible, first, for the loss of old jobs, and second, for the creation of new ones so that the number of employed remained the same or was increased.

**T**ODAY millions of men, able to work, are out of jobs. They see a machine doing the work of a hundred thousand men, and they blame idleness and suffering. But all over the world men are out of work—they are cold and hungry in the countries where a machine is not developed, where handwork is still the main source of production.

These facts must mean something to those who claim to know, who have made a study of the ups and downs of times. They say the millions are jobless today because of economic conditions with which the machine has nothing to do. These are the ones who blame over-production of products like coffee, sugar, etc.

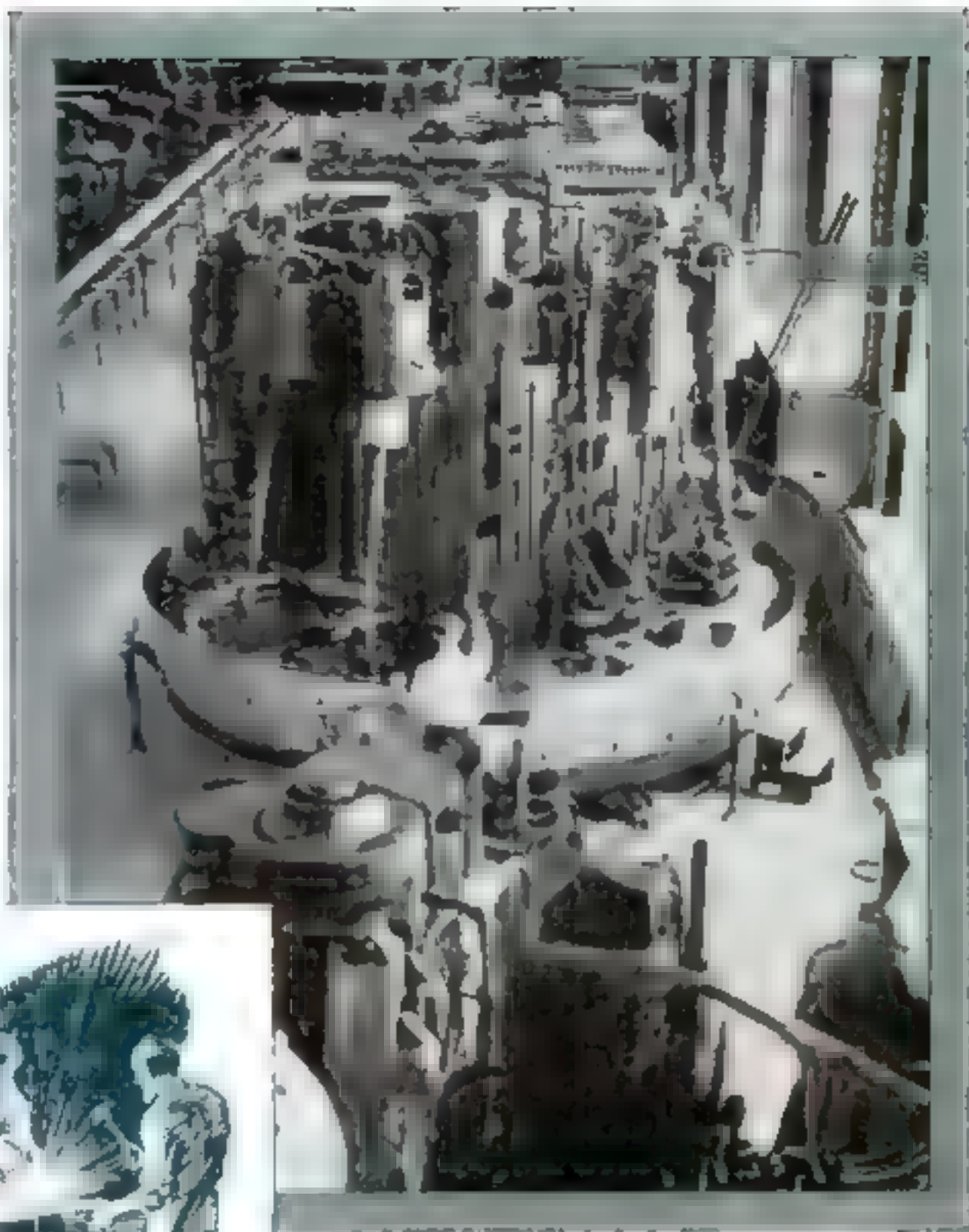
Still others will always blame the machine as being the thing bondest to kick. Am I wrong then when I point the machine on its shining back and show instances to show that it makes instead of ending them? If you imagine trying to meet the demand of Chicago, New York, London, Paris with handmade, hand-packed, hand-transported produce! Could it be done? Could civilization, as you know it today, carry on without the machine? Where then are you going to set a limit and say up to this point the machine is good and beyond it it is bad?

To banish labor-saving devices would deal a death blow to all machinery. For the same type of mind, the same kind of research, that creates labor-saving machines also produce the thousand-and-one devices that do not save labor and that have become indispensable to our civilization.

Take, just as one example, the late Elmer A. Sperry. Back in 1888, he invented the first electric chain mining machine, a labor-saving device if ever there was one. But since then he also has given us the gyro-compass and the airplane and ship stabilizer, now absolute necessities to navigation and aviation.

**T**HROTTLING invention and research suppose it were possible, would be one of the worst calamities that could befall mankind. Picture, for a moment, a world without electric light, without automobiles, airplanes, steam engines, tractors, telephones, telegraph, radio, moving pictures, cranes, elevators, typewriters, the X-ray, and modern surgical instruments, to name but a few. These and countless other inventions and mechanical developments have contributed to the comfort, happiness, and health of the human race. Also, don't forget they have given jobs to millions of workers.

The automobile itself—especially the truck—is a labor-saving device. It has done away with untold drudgery by men



and horses. When its use first became widespread numbers of men such as blacksmiths, wagoners, wheelwrights, saddlemakers, lost their jobs. But since then, it has given work to a huge army of men.

The National Industrial Conference Board has no axe to grind. It wants facts, truth, and maintains a bureau of research for the purpose of finding out what's what in industry. Dr. Magnus W. Alexander is president of this Board, which probably knows more about what's going on in the factories and distributing plants of the world than any other existing organization.

**"IS IT TRUE?"** I asked Dr. Alexander, "that machines put men out of jobs and by so doing take the food out of their mouths?"

His reply was an emphatic "No." The idea that improved machines mean fewer jobs, he told me, has been proved false by an extensive survey made by his organization.

Naturally, he said, the use of labor-saving machinery means fewer men for

But labor-saving machinery has set up and expanded the machine-building industries as well as lowering production costs. The net result is not only lower prices, but also higher wages.

**A**LSO he explained, lower prices lead to a greater demand. For example, when automobiles were made so cheaply that you and I and thousands of others could afford to buy them, we got them. As a result, the men who were thrown out by labor-saving machinery were rehired, often along with many others, in an effort to make the output meet the demand.

Few industries are self-supporting. More automobiles mean more rubber, more upholstery fabrics, more glass, more steel, and more of other raw materials and articles. This increase all down the line makes jobs for many additional men. Meanwhile, higher wages increase the national purchasing power. That means more business, more work—an endless chain.

Also this greater volume of goods must be distributed. Thus, again thousands of new jobs are created. In the case of articles like the automobile, thousands of men are needed. (Continued on page 116)





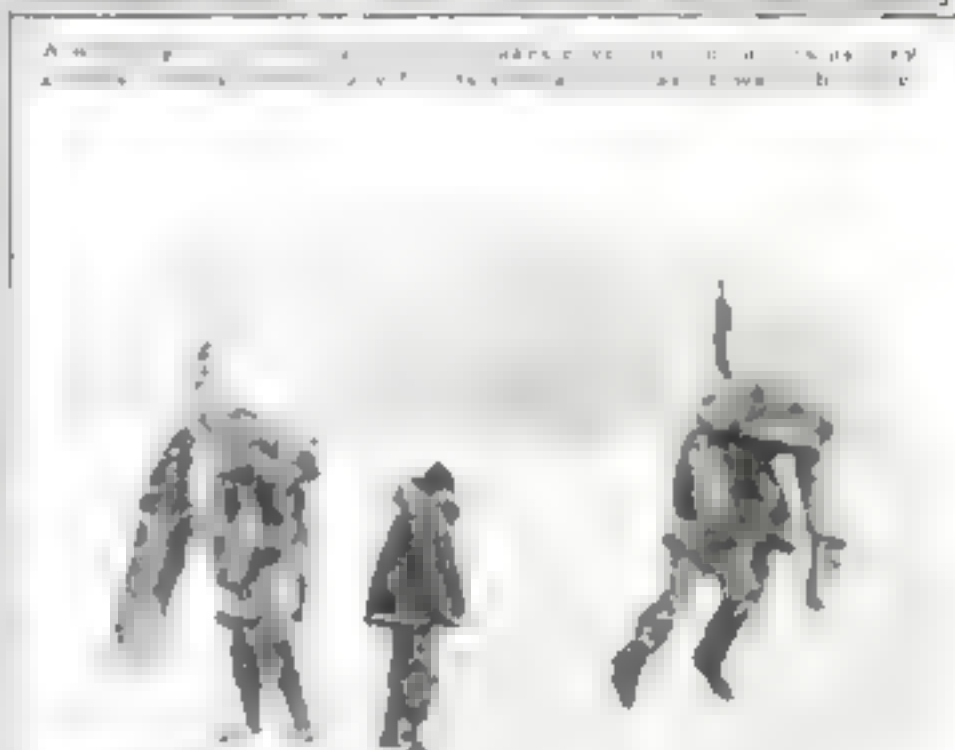




This is the first time I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.



During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.



During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.



During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.

During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.

When I was in the Arctic, I saw the first of the polar bears. During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.

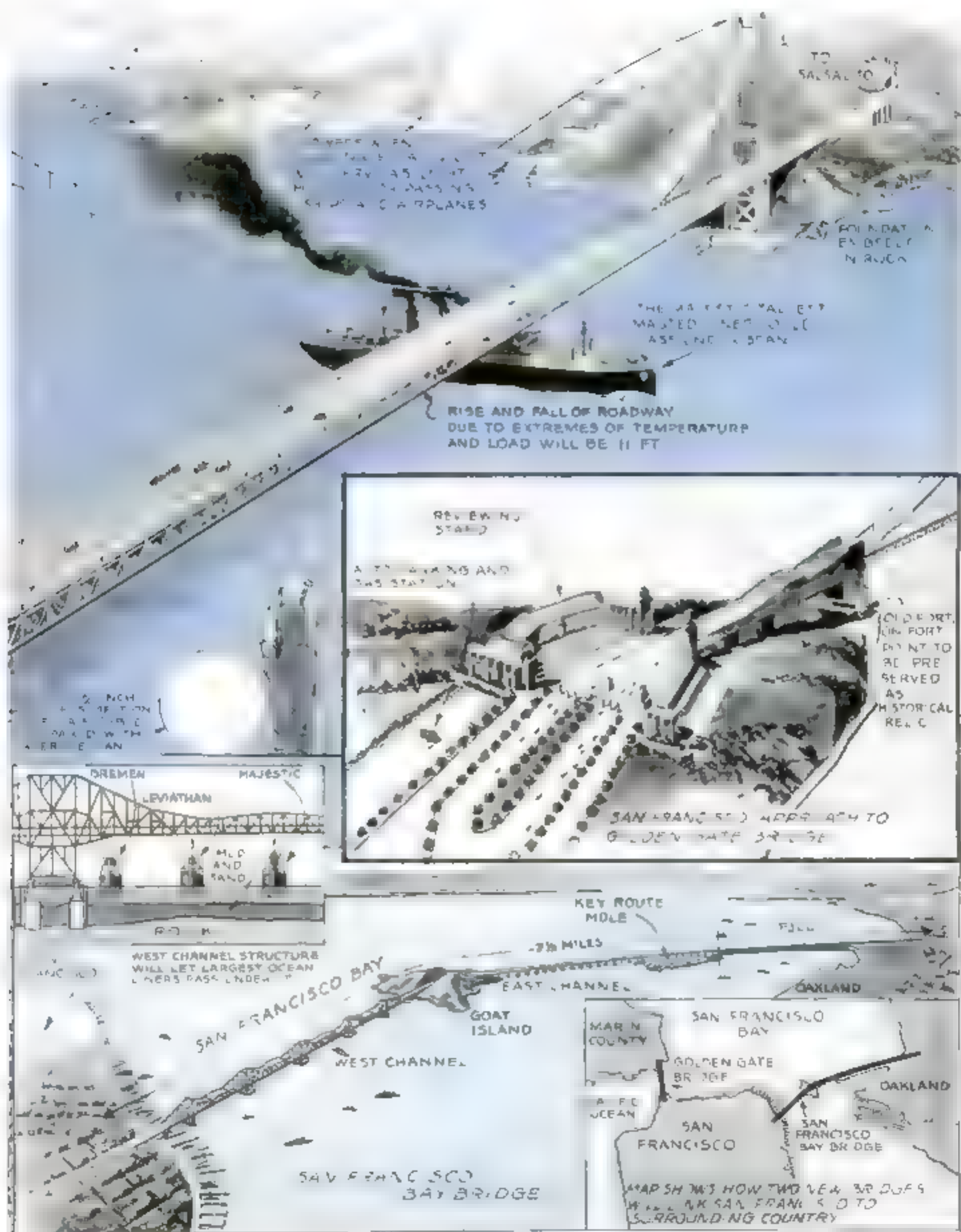
When I was in the Arctic, I saw the first of the polar bears. During the winter, I was taken to the Arctic by the ship. When I was there, I saw the first of the polar bears.







# World's Greatest Bridges

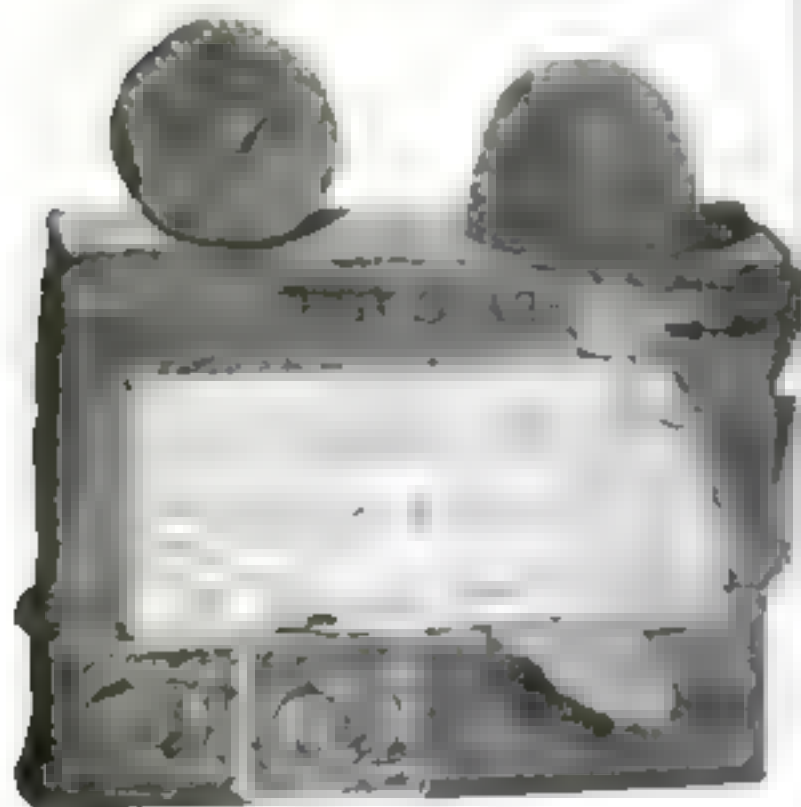




# Science Is *Bloodhound* at Heels of Forger

*Chemist and Handwriting Expert Is Sherlock Holmes in War to End Frauds That Cost \$150,000,000 a Year*

By EDWIN W. TEALE



Note the phantom letters behind address on card that helped solve strange poison gum-tup case

**F**ORGERY is on the increase. According to William B. Joyce, chairman of the National Surety Company of New York City, this crime is mounting due to present business conditions. The yearly loss from forgery in the United States is \$150,000,000—a sum equal to the combined incomes of more than 70,000 average wage earners! In one recent week, the toll taken by forgers in a single eastern city was \$300,000. The battle against the criminal penman has assumed new importance during the past fall and winter.

In this battle, handwriting experts, cameras, chemicals, and microscopes are used in the search for clues in the strokes and curves left by the criminal's pen. Some of the results are almost uncanny. For instance, witness a recent case in Pennsylvania.

Secret Service men who had been sent to Pittsburgh to take up the trail of a forger who had passed a large check, returned to Washington, D. C., baffled. The trail ended with the store clerk who received the worthless piece of paper. He had taken in fifty checks that day and was

"Ask the clerk if a man about thirty-five years old, well educated and having a German accent, came to the store this day."

They followed his advice. The clerk immediately shouted, "That's the man I remember him now. He was the one that gave me the check!" The operatives trailed the forger to Ohio and placed him under arrest.

How did Farrar know that the forger was thirty-five, well educated and had a German accent? I asked him that question recently in Washington. For answer he drew a chart from his desk, a chart upon which he has been working for years. It contains English words written by people of various countries and illustrates national traits in writing.

**I**N THE case of the Pittsburgh forger, a curiously-formed letter or two revealed to Farrar's expert eye that the penman had learned to write English in a German private school before the war. This showed he was of German birth, indicated he had had a good education, and suggested that his age, adding the elapsed



W. B. Farrar, U. S. Treasury Department handwriting expert, examining a check which was passed by a forger who had a German accent

time since the war started to the average of private school boys before it began was close to thirty-five.

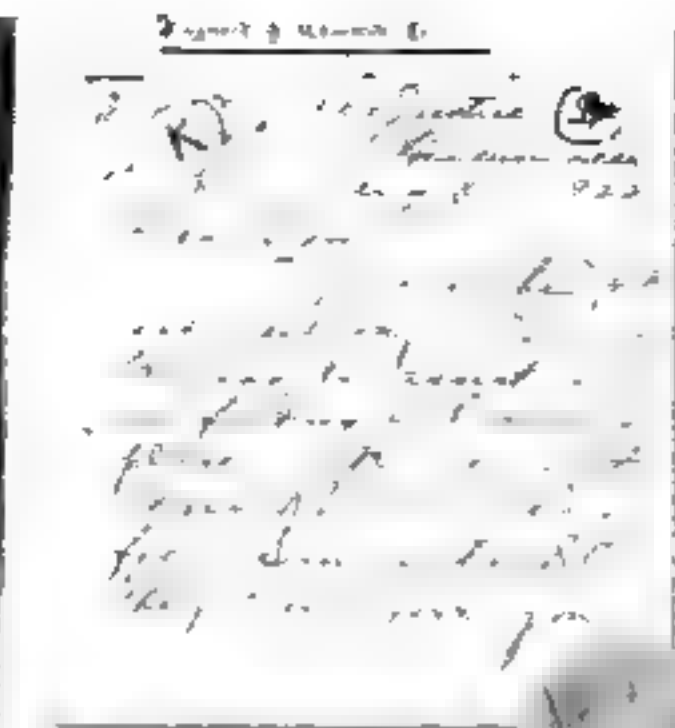
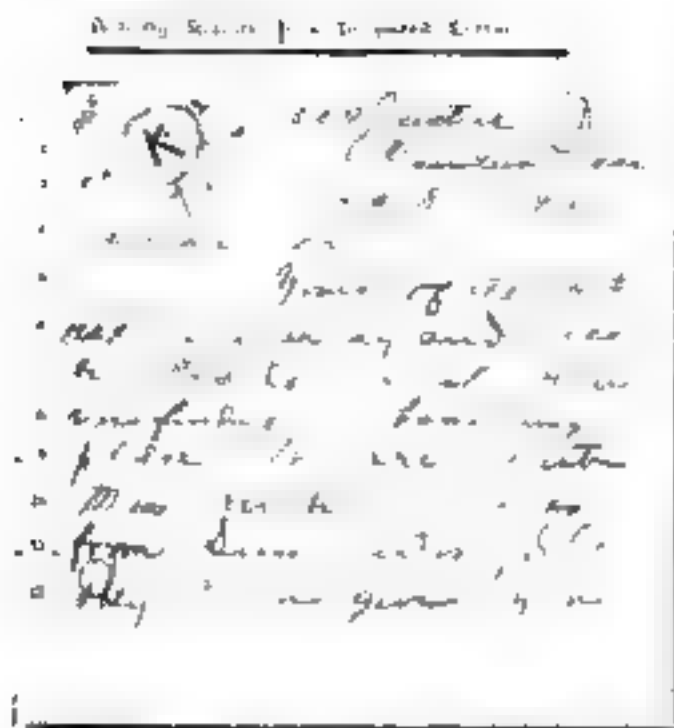
Each year between thirty and forty million checks pass through the Treasury Department in Washington. The daily flood sometimes reaches a high tide of 250,000. In spite of precautions, there are occasional fraudulent endorsements on these Government checks. Then Farrar's work begins. Last year, he traveled 40,000 miles testifying in court in connection with forgery cases of various kinds.

**C**ONTRARY to general belief, only five percent of the checks which are criminally tampered with are "raised"; that is, altered to represent a higher sum than that originally placed upon them. Nine and five percent changed for purposes of fraud are deliberately forged with false signatures or payee's endorsements.

Such forgeries are made by three types of criminals: the "Ground Glass Workers," the "Sketchmakers" and the "Free Hand Artists." The first places a valid check or a paper containing an original signature on a plate of ground glass under which a light is shining and traces the signature as a child traces a picture by holding it against a window pane.

The second makes a "skech" of the signature, frequently by rubbing lead from a pencil on the back of a check and then, by tracing over the signature, transferring a "carbon copy" of it to another piece of paper. When this "carbon copy" is traced over with ink the transfer is complete.





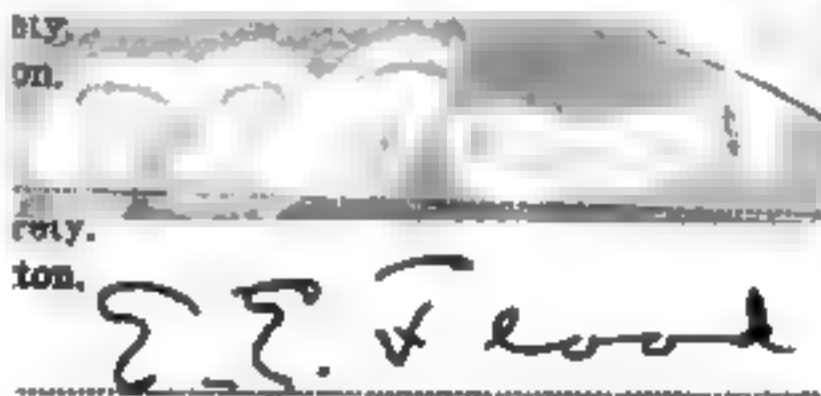
At left robust letter made of pieces cut from anonymous letters and used to prove the similarity of writing in them, and the admittedly genuine letter shown at the right.

The most dangerous forger, however, is the one who obtains an original signature and then practices copying it until he can dash off an exact duplicate. Not long ago, Farrar asked one of these "Free Hand Artists" to write a name he had forged more than four months before. Without hesitating he produced an exact imitation of the real signature.

A traced signature can be detected almost instantly by an expert with a microscope. When a hand slowly follows an unfamiliar path the line always wavers slightly. Instead of a clean-cut stroke, the result is ragged. To account for such wavering in traced signatures ingenious excuses often are offered in court. Once, in a case in Montana, it was claimed that the signature had been made on horseback. Another time in a New York court it was alleged that the wavering letters had been penned in a taxicab riding over an uneven pavement.

**TRACED** signatures often are detected by the attempts to erase the lead over which they have been traced. These erasures are visible under a microscope or when the check is placed on a ground glass against a light. In one of Farrar's cases, a tiny bit of lead under the ink of a signature proved that it was a "sketch." With chemicals, he removed the ink and revealed the carbon signature below.

Usually, Farrar told me, personal peculiarities that characterize a forger's own penmanship will appear in his attempts to imitate another's handwriting. In fact, according to this authority, it is almost impossible to disguise handwriting so the expert will be fooled. A fake medium was exposed by a handwriting expert who examined twenty slates upon which twenty different "spirits" were sup-



Chemicals brought the forgery to light in this case. At top the pencil signature is seen with the ink tracing removed.

posed to have written messages. The writing was the same in every case.

The fact that shading in writing is always made in toward the palm of the hand enables the expert with his magnifying glass to tell at a glance whether the writer is left- or right-handed. He can also determine the position in which the pen was held in relation to the body and

between which fingers it was grasped. The general style of the writing will sometimes indicate the approximate age and origin of the writer as different styles have been taught in various schools at various times. The microscope in the hands of an expert also tells much about the kind of pen a forger uses.

For example, in Baltimore some years ago, Farrar was able to testify in court that the forgeries on two checks presented the same day by the same man were made



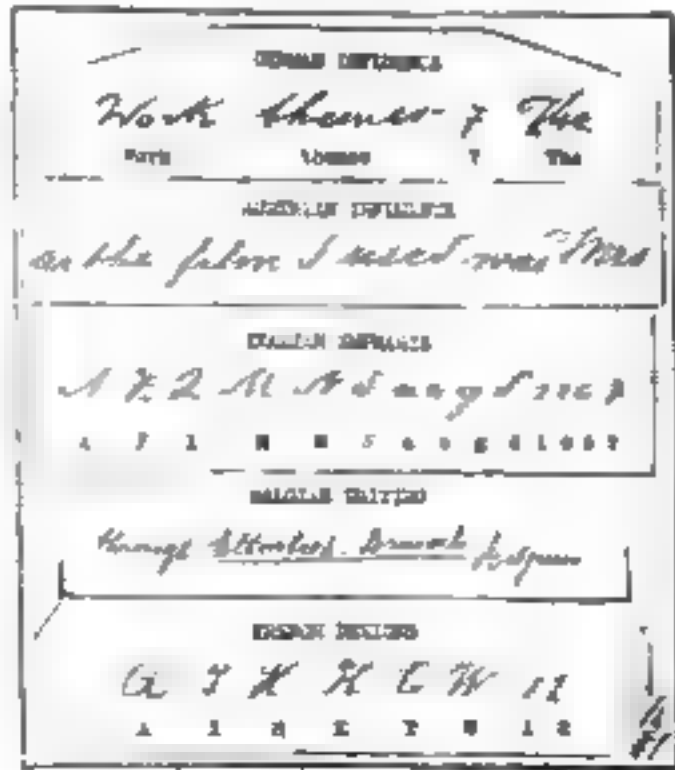
Chemicals applied to signature written with iron ink brings out traces of the original writing.

with different pens, one gold, the other steel. The crook confessed that he had written one with a fountain-pen on a steel car and the other with the pen at the bank. The invisible iridium points soldered to the tip of a gold fountain-pen cause it to move smoothly over the paper while the sharp point of a steel pen digs into the paper.

**"AS BLACK as ink"** is a simile that is good enough for ordinary use, but not for the handwriting expert. For him, there are a dozen shades of blackness, each telling its story. Over a period of years, Farrar and his assistants have been carrying on tests with all the well-known brands of ink, recording the chemical contents, color and other characteristics at different periods after they have been used in writing.

The reaction of a sample of ink to more than a dozen chemicals is noted at monthly intervals over a long period of years. One purpose of the test is to discover a means of judging the age of writing by the condition of the ink.

The two types of inks in general use are fugitive inks and iron inks. The former can be so completely removed that they leave no trace. But the iron inks, which contain iron salts in suspension in hydrochloric acid, bite into the paper and leave some of the iron embedded in it. In time this writing turns reddish and fades, but by applying chemicals it can be restored. George Washington's will was written with this kind of ink and later restored in this manner. (Continued on page 34)



Farrar's chart shows influence of nationality on writing. This often gives valuable clues.

# Will Autogiro Banish Present Plane?

By ASSEN JORDANOFF

At thirty miles an hour, the autogiro drifts lazily along far above the earth.

**I** HAVE just had the biggest thrill of my twenty years of flying. I have piloted an autogiro. And I have seen this amazing windmill plane "do the impossible."

It is, I am positive, the flying craft of the future.

At Pitcairn Field, fourteen miles from Philadelphia, Pa., James Ray, chief test pilot for the Pitcairn-Cierva Company, explained the design of the strange machine and took me for a passenger hop. We landed at the far side of the field. The spinning windmill over our heads slowed down. Its four yellow vanes, long and slender like blades of grass, drooped to a standstill above the bright green fuselage. Ray climbed from the rear cockpit.

"All right," he said, "you can take her up now."

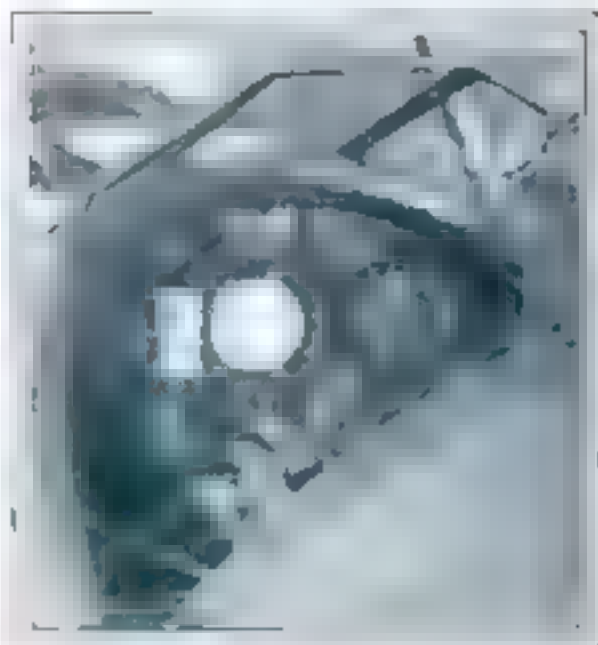
I settled into the pilot's cockpit and buckled the safety strap. Ahead of me, at the nose of the conventional fuselage, was a 225-horsepower Wright Whirlwind engine and its steel propeller. Beneath me was the small black stabilizing plane with ailerons and curiously upturned ends. At the rear were the usual tail surfaces of an airplane. But above me was the striking feature of the strange machine.

At the top of a mast of three black steel tubes was the "rotor head" to which the long windmill, or rotor, vanes were attached. Each vane was free to move up and down. When the ton and a half mass of the machine is supported by these vanes there is nothing to keep them from "coning up," like an umbrella turned wrong-side-out—except centrifugal force!

The only bracing wires on the windmill are small "droop wires" placed above the vanes to keep them from dropping to the ground and becoming damaged when at a standstill. In an autogiro, you "ride on centrifugal force." By the time the windmill is spinning at a hundred or more revolutions a minute centrifugal force is stiffening out the vanes with a pull of



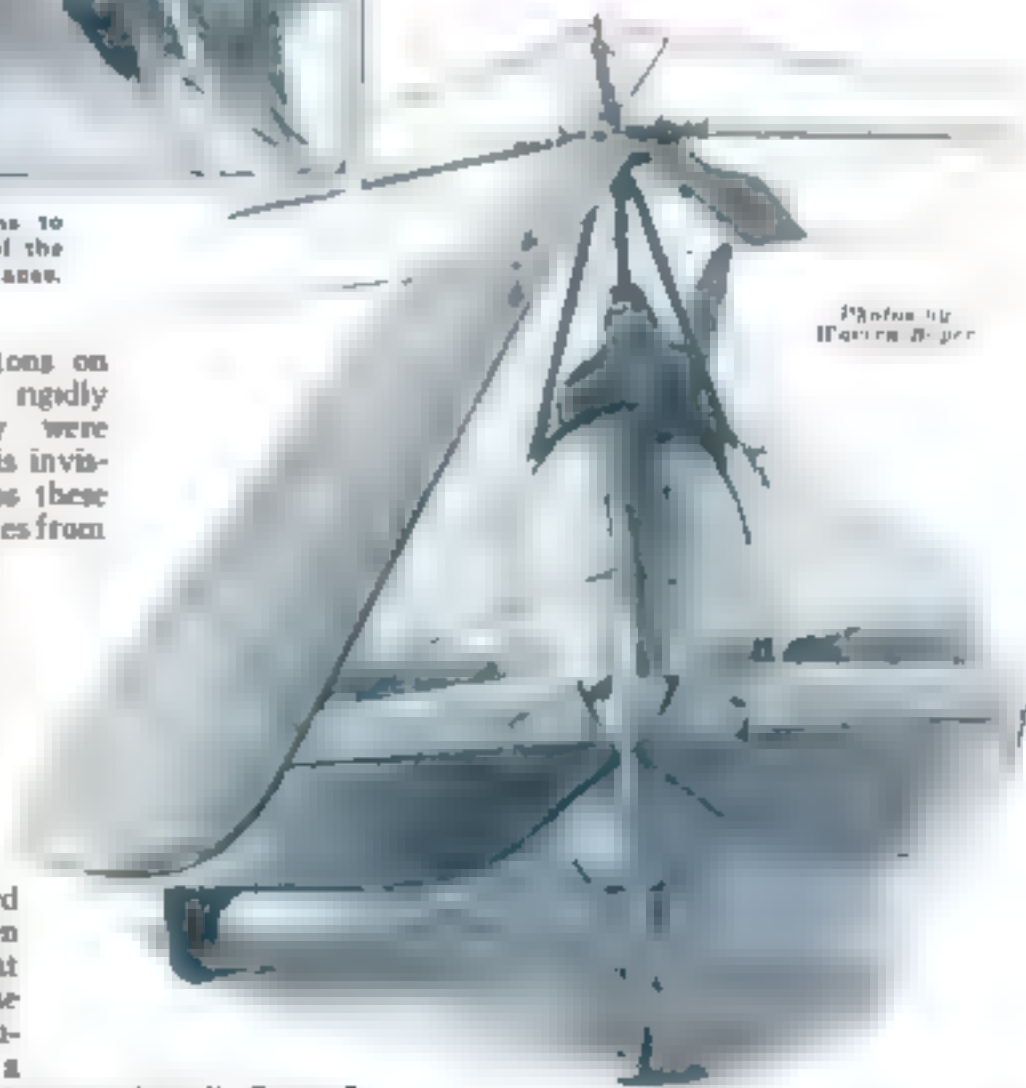
James Ray, right, explains to Jordanoff the mechanism of the new plane's windmill vanes.



Pulling out the knob on the instrument panel connects the vanes with the motor.

more than two tons on every blade. As rigidly as though they were made of steel, this invisible bracing keeps these almost flimsy blades from folding upward.

Ray pointed to a small lever at the right of the instrument board marked "rotor brake." That, he explained, holds the windmill from being turned by the breeze when the machine is at rest. Below the center of the instrument panel was a large knob labeled "rotor drive." Instead of taxiing back and forth across the field to get the rotor spinning the Pitcairn machines are equipped with a drive shaft



Photos by Warren B. per

Jordanoff in cockpit beneath drooping vanes, ready for his first autogiro flight. The autogiro, except for the horizontal windmill vanes overhead, has the appearance of an ordinary plane.





Jordanoff studies the great, Army-like vane held rigid in flight by centrifugal force

from the engine, to save time. Pull out the knob and the drive is connected. Push it in and it is disconnected. In the air, the windmill is never operated by the engine. Its vanes are turned by the air rushing past them.

This brings up a common misconception. Many people think the autogiro is a form of helicopter, that its whirling windmill pulls it vertically upward. This is not true. Each vane is a separate airplane wing. It lifts, just as does the usual aircraft wing, by moving rapidly through the air. In the ordinary airplane, the amount of lift given by the supporting surface is entirely dependent upon the forward speed of the machine. Because the vanes of the autogiro turn at high speed, they continue to exert their lift even when the craft has come to a standstill.

With the Whirlwind idling, I pushed ahead on this lever, freeing the windmill. Then I pulled out the knob. The long vanes, extending far out beyond the nose and the tail of the fuselage, began to move. Directly above the knob on the instrument panel is a round-faced dial. It shows the revolutions per minute of



The only brace wires on the windmill are small drop wires above the vanes to keep them off the ground

the rotor. Between it and the engine tachometer, a white card gives the number of revolutions of the rotor at different engine speeds.

With my feet on the brake pedals, holding the landing gear wheels, I watched the two instruments. The needle of the engine tachometer advanced to 800. The merry-go-round above my head moved faster. The rotor tachometer showed it was turning sixty-three "revs" a minute. When the Whirlwind was turning 1,000, the rotor was making seventy-nine. The machine rocked and vibrated as the forty-eight-foot windmill speeded up. Faster and faster the reflections of the vanes raced across the glistening black surface of the stabilizing wing. On sunny days, Ray



I had hardly moved the stick," says Jordanoff, "to lift the tail, when the ship shot up

told me, the checkered light and shadow made by the whirling rotor sometimes distracts a pilot unfamiliar with the machine.

Now the whistling sound of the rotor was drowned in the roar of the whirlwind. It was bellowing at 1,500 revolutions a minute. The windmill was streaking around at 118. I was ready to take off.

I shoved in the knob of the rotor drive. Hereafter, the air striking the vanes would prevent them from slowing down. I slipped my feet from the brake pedals to the rudder pedals. The released ship raced down the field. I had hardly moved

the stick to lift the tail when the ship seemed snatched into the air. An ordinary airplane runs several hundred feet before it takes off, often at a mile a minute speed. The autogiro gets off in less than thirty yards and takes to the air at twenty-five miles an hour.

I was climbing at a steep angle. The fact that an autogiro will take off at an angle from fifty to ninety percent steeper than an airplane has led it to be hailed as the "back yard plane" of the future. Any plot 400 feet square, I was told, will make a four-way flying base for a "windmill plane." Already a five-passenger cabin autogiro is under construction in England for land-

ing and taking off on roof tops and small plots in large cities.

For private owners, little machines with ten-foot vanes are entirely practicable, designed with vanes that fold together like the blades of a jackknife so the machine can be stored in an ordinary garage.

At an altitude of 600 feet, I leveled off. I had the queer sensation of flying a plane with the wings gone. I glanced upward. The vanes of the rotor were still milking around at dizzying speed. The air was bumpy, filled with up and down currents. But the flexible structure of the machine "ironed out" these ruts of sky travel. The vanes "give" just enough to cushion the drops. Only occasionally did I have to



The windmill vanes, designed with the greatest care, are put together with the utmost accuracy in the factory.

move the standard airplane controls by which the machine is guided. The plane almost flew itself.

I pulled back the stick and climbed to 1,200 feet. An autogiro's ceiling is around 20,000 feet; its high speed, over two miles a minute. Cierva, its inventor, is planning a racing autogiro which is expected to pass the 200-mile-an-hour mark. The "windmill craft" has whirled vertical dives at 140 miles an hour carrying 600 pounds of sand. It will do anything an airplane will do and, while these stunts have not been attempted yet, there is no aerodynamic reason, Ray told me, why they cannot loop the loop and fly upside down.

At the top of the quick climb, I got my only scare on the flight. I leveled off suddenly. I was watching the rotor tachometer at the moment and saw the needle drop back from 115 to 105. The rotor had lost ten revolutions. Was it slowing down? I shot a glance up at it. The vanes seemed turning slower and slower. But when I glanced back at the instrument the needle was back at 115 again.

Later, I learned that at the top of a fast climb, when the load on the vanes is suddenly lightened, they lose about ten revolutions. But as soon as the weight comes back on them again, they speed up. The greater the weight on the "windmill," the faster it turns. Tests have shown that

there is no conceivable position in which the autogiro might be placed where the blades would cease revolving or slow down below the danger point.

I eased back the throttle. We drifted across the sky at thirty miles an hour. Rolling Pennsylvania hills, light brown winter fields, hushed orchards of leafless trees, spread out below. I gave the Whirlwind the gun and watched the air speed indicator hand creep ahead to 50-70-90-115 miles an hour. On a cross-country flight, the autogiro can maintain a cruising speed of ninety-five miles an hour. In a flight from Philadelphia to Chicago for the National Air Races last fall, Ray covered the 700 miles in six hours and forty minutes.

One after the other I tried skids, side slips, climbing turns, feeling out the machine. I found I had to press slightly harder on the rudder pedal to make a turn, but the stick control was more sensitive than on an ordinary plane. The ship made sharper turns at slower speeds than would be possible in the best of airplanes.

By now I was down to 800 feet. I nosed up slightly into the wind and eased back the throttle. The thunder of the Whirlwind sank away. The rustle and whistle of the spinning vanes seemed to increase. The air speed indicator hand slid back until it was nearing twenty. I was trying a stall. Already I was far below the flying speed of the lightest plane. Subconsciously, I braced myself for the terrific downward plunge or the dizzying

tail spin that follows a stall in an airplane. But nothing of the kind happened. We seemed floating in space.

I looked over the side of the cockpit. We were directly above the high water tower at the edge of the field. The yellow letters circling its top, "PITCAIRN FIELD," were slowly rising toward me. I was settling straight down through the air. The ship was coming down out of the sky like an elevator.

The faster the autogiro settles, the faster the rotor spins, just as a windmill speeds up when the breeze freshens. No matter at what altitude the machine is stalled, it merely settles. In the "flying windmill," the deadly tail spin is unknown. The reason is that the wings continue to rotate at hundreds of miles an hour and so maintain flying speed even though all forward movement of the craft has stopped.

It was a tail spin that led Juan de la Cierva, the Spanish designer, to invent the autogiro. (Continued on page 146.)

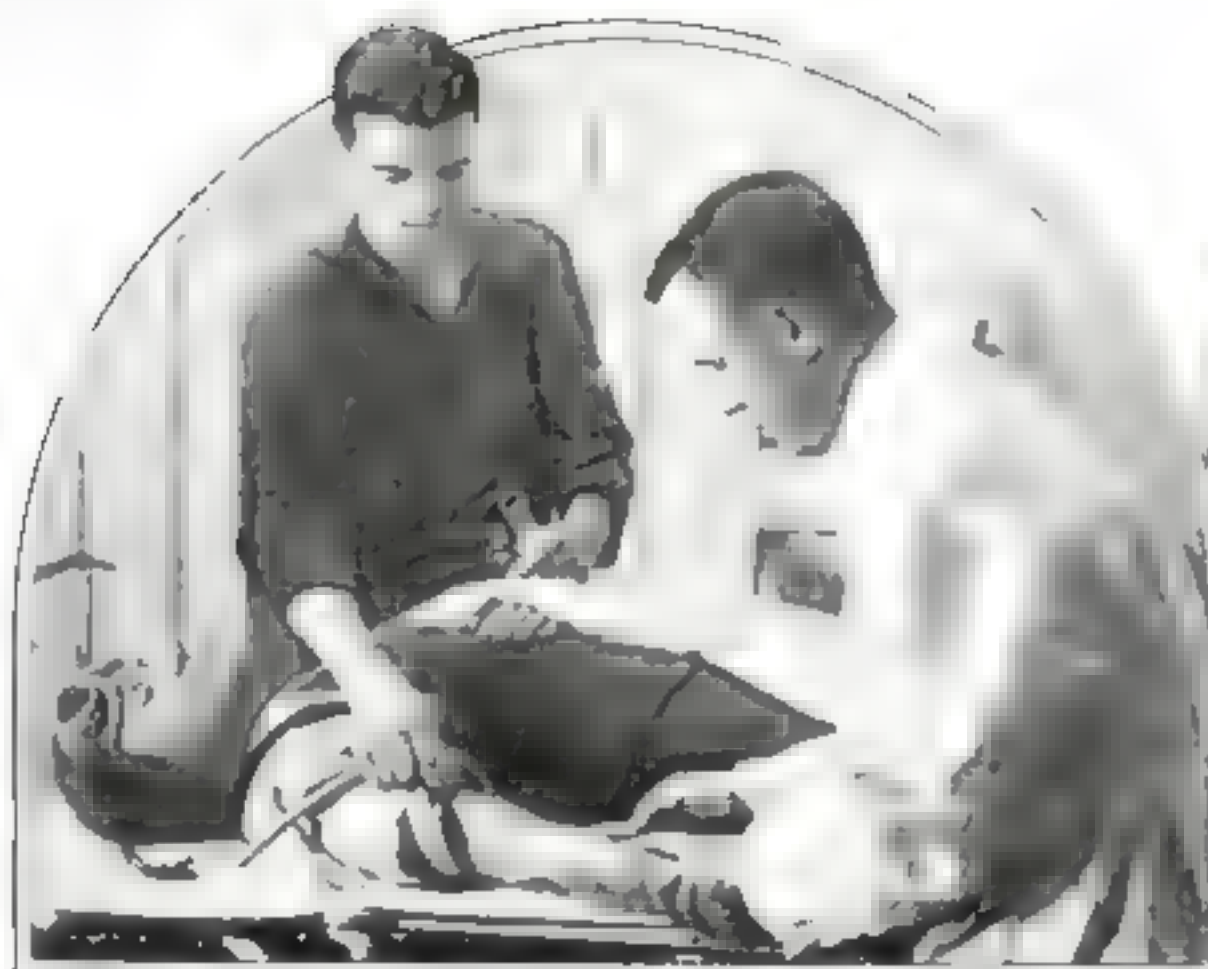


In circle Jordanoff examines the manner in which the vanes are attached to the plane. Above, Ray, right, explains to Jordanoff exactly what the vanes are designed to do.

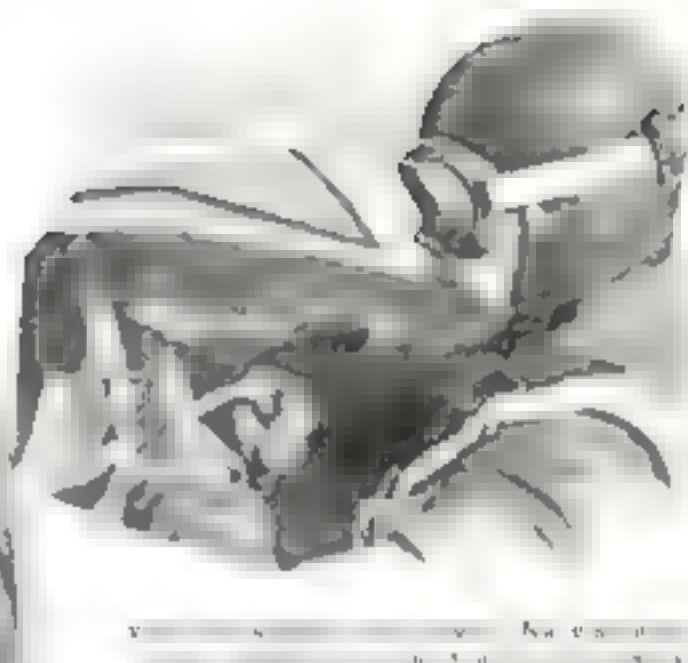
At left, Jordanoff and Ray inspect the landing gear. In his first landing Jordanoff expected a rough jolt when he hit the ground but he struck with only a slight jar.







Lieutenant Commander Joel J. White, Navy Flight Surgeon, is taking a blood sample from an aviator following a flight. It will be tested for possible traces of monoxide.



fastest leads in the two planes. They found ways to switch the air currents to the side, so they would not be swept along the fuselage into the cockpit without interfering with the ship's proper stream-line or materially reducing motor efficiency and speed. The tests then were repeated, and not a trace of the gas was found.

**THREE** kinds of exhaust lead-systems were tried out. The first is known as the "bayonet stack," consisting of a series of individual exhaust stacks shaped like bayonets, each of which is attached to a separate cylinder of the engine. This type of lead is about a foot long, two and one-half inches in diameter at the point where it joins to the cylinder, and tapers gradually to less than half an inch at the rear end.

The second also was an individual type of exhaust lead, but an ordinary round pipe was used instead of the bayonet stack. The third system involves what is known as manifolding the exhaust outlet, meaning that the outlet systems of several cylinders are grouped so that a single exhaust outlet is provided for each group.

Twenty-five research experts and pilots participated in the experiments conducted over a period of two months at the Navy Air Station at Annapolis, D. C. The research program centered around two types of test. First, blood samples taken of a pilot and other occupants of a plane

were examined in the laboratory for possible evidences of the deadly gas. Secondly, air samples taken by means of a special device from the cockpit or cabin of each plane tested were examined in the laboratory.

The blood tests were made in this manner. To the blood in the test tube were added water and pyrogallol and tannic acid, a mixture which gives normal blood a light gray color. If carbon monoxide is

present, the color will turn pinkish when the acids are added, the exact shade depending on the amount of poison present. (Continued on page 149)

# Navy Rids Airplanes of Deadly Gas

By JAMES NEVIN MILLER

**C**LOSELY following announcement of Dr. Miller Reese Hutchison's invention of a "monoxide meter," which was described in the February POPULAR SCIENCE MONTHLY, U. S. Navy officials disclosed the details of the most extensive

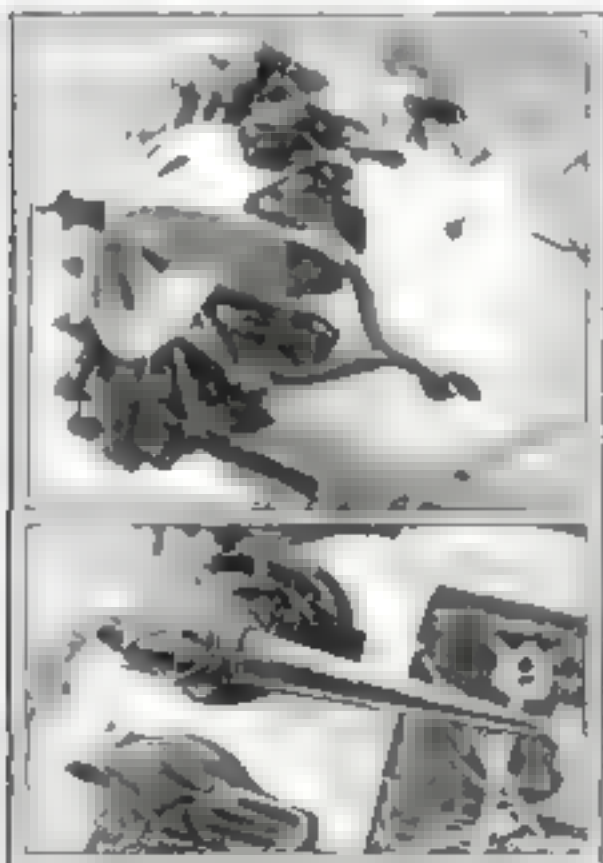
study ever conducted for the purpose of eliminating the carbon monoxide menace from flying.

The device of Dr. Hutchison, formerly chief engineer for Thomas A. Edison's automobile drivers and airplane pilots when their engines exhaust fumes of the deadly gas.

Government tests, which have just been completed under the direction of Lieut. Commander Joel J. White, Navy Flight Surgeon, disclose that the danger of monoxide poisoning appears to be present only in two types of open-cockpit planes. All of the craft ships tested proved free from the menace.

The reason, the experiments showed, is that the monoxide fumes usually enter a plane on air currents that carry them back from the exhaust of the engine, following the general contours of the fuselage. Naturally, the entrance of gas in this manner is next to impossible in a cabin plane.

The investigators concluded that the remedy lay in changing the direction of



At top, the Navy's new manifold type of exhaust outlet and below is the bayonet type.

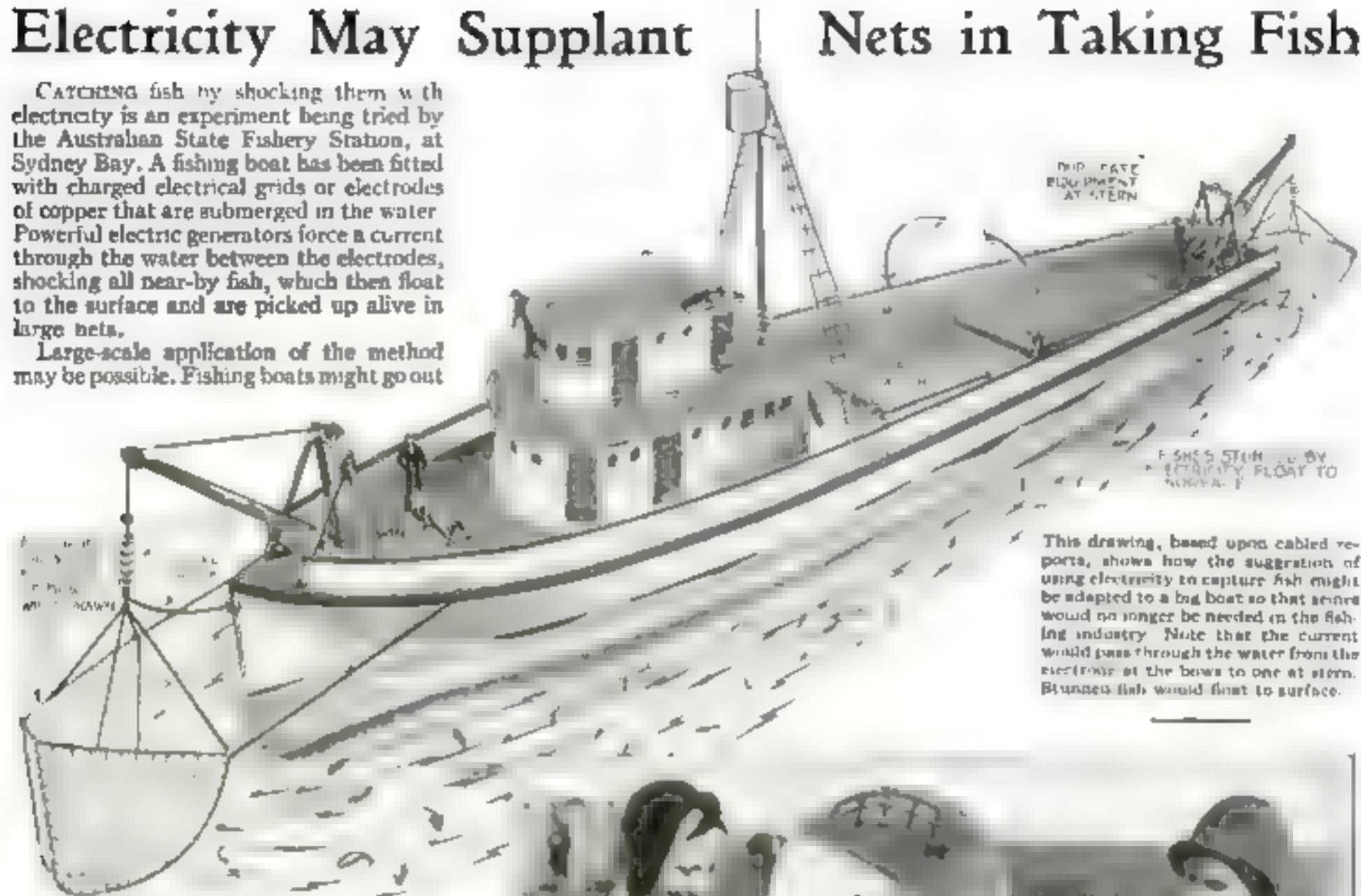


Blood samples are compared with standard specimens to see if gas is present.

# Electricity May Supplant Nets in Taking Fish

CATCHING fish by shocking them with electricity is an experiment being tried by the Australian State Fishery Station, at Sydney Bay. A fishing boat has been fitted with charged electrical grids or electrodes of copper that are submerged in the water. Powerful electric generators force a current through the water between the electrodes, shocking all near-by fish, which then float to the surface and are picked up alive in large nets.

Large-scale application of the method may be possible. Fishing boats might go out



This drawing, based upon cabled reports, shows how the suggestion of using electricity to capture fish might be adapted to a big boat so that seine would no longer be needed in the fishing industry. Note that the current would pass through the water from the electrodes at the bows to one at stern. Stunned fish would float to surface.

singly or in pairs, to fish electrically. Single boats would have electrodes at bow and stern. If two boats operate together, each would use a single electrode and an electric cable would connect them.

A Swedish engineer named Moller devised this electric fishing, after making good hauls with an electrified rowboat. The drawing on this page, based on cabled reports of his system, shows how it might be adapted on a large wooden-hulled fishing ship. A metal hull could not be used, as it would short-circuit the current.



## COSMIC RAYS MAY FORECAST WEATHER



Dr. R. A. Millikan, who is using this electroscope with which he is studying the cosmic rays. He believes these mysterious rays may be used in making reliable forecasts of the weather.

... rays may help to prophesy the weather. This first practical use for the mysterious radiations from outer space was recently announced by Dr. R. A. Millikan, Calif. Institute of Technology physicist.

The "cosmic rays" are more penetrating than radium or X-rays, but it is not known whether they affect human beings.

Dr. Millikan, who discovered the source of the rays (P. S. M., July, '28, p. 13), has measured their strength with his new electroscope, and is able to determine high-altitude atmospheric conditions.

## AUTOMAT CLEANS AND PAINTS GOLF BALLS

Drop a coin in the slot and this machine will automatically clean and paint your golf balls. Electric mechanism dips the ball in a mixture of lacquer, then holds it in a strong current of warm air and when dry delivers it to the player ready for use. One of the machines is now in use on a Los Angeles, Calif., golf course.

The device is appropriately shaped like a huge golf ball on a tee.

## RECORDS FIRE CALL

PROBABLY the most excited conversations preserved on wax records are those kept by the Portland, Ore., fire department. When an agitated voice announces over the telephone, "My house is on fire!" a dictating machine is plugged in to record the conversation. If he mumbles the address and hangs up before the operator can ask him to repeat it, it is necessary only to play back the record.



## PRIVATE RAILWAYS CLIMB STEEP HILLS

High up on the sunny hillsides of California are many homes—but climbing to some of them is hard work. William Schoenfeld, motion picture engineering expert, didn't like the climb to his home near Beverly Hills, so he built a small electric cable railway to carry passengers up and down. An electric motor furnishes power for this little private road that is operated by push buttons at both ends.

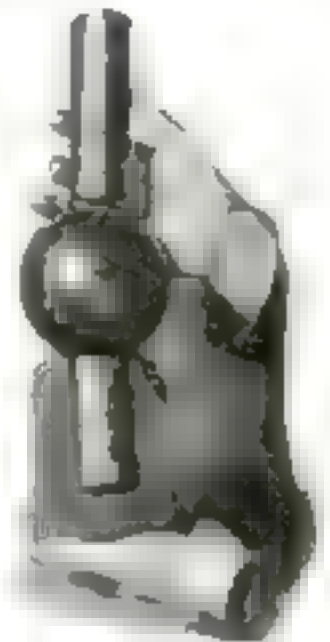
Charles V. Mars, of Los Angeles, has no objection to the climb to his home from the road, but he didn't like carrying suitcases up it. He also built an inclined railway, but one for freight only. It is operated by a one-third horsepower motor that hauls one-hundred-pound suitcases to the road to the top in forty-five seconds. The picture at the right shows the steep incline up which the electric car runs to reach the Schoenfeld home. Below it is close-up view of Mars' car.



Charles V. Mars, Los Angeles, at the cable car of the inclined railway.

## NEW MUSICAL CHIME REPLACES DOORBELL

A single musical peal chime announces a caller at the door of your home, when new electric "door chime" is substituted for doorbell.

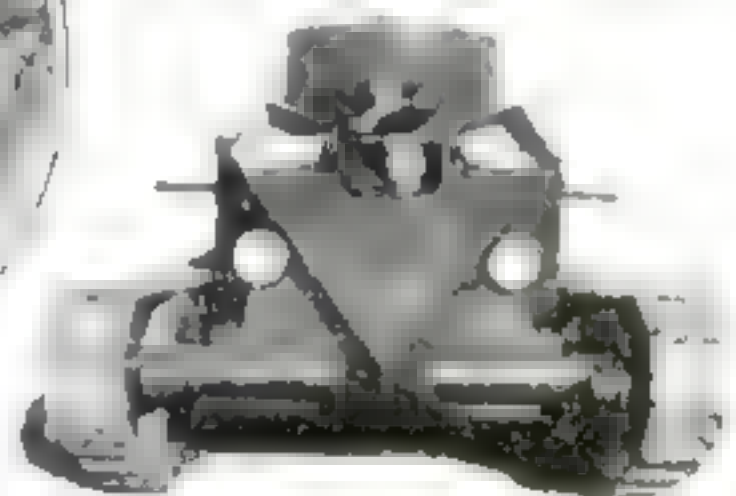


Only one note is sounded when the doorbell button is pressed, even if it is held down by an impatient visitor. A removable resonator tube magnifies the tone so that it may be heard from any room.

This new musical chime is a new invention of the Bell Telephone Company.

## RADIO FINDS BURIED COIN

Some of the greatest treasures of Roman and Greek antiquity have been aided by a new radio instrument that detects buried metal. When it is carried over the ground, buried metal objects cause a disturbance registered on an electric meter. This instrument is used to detect the presence of a single coin.



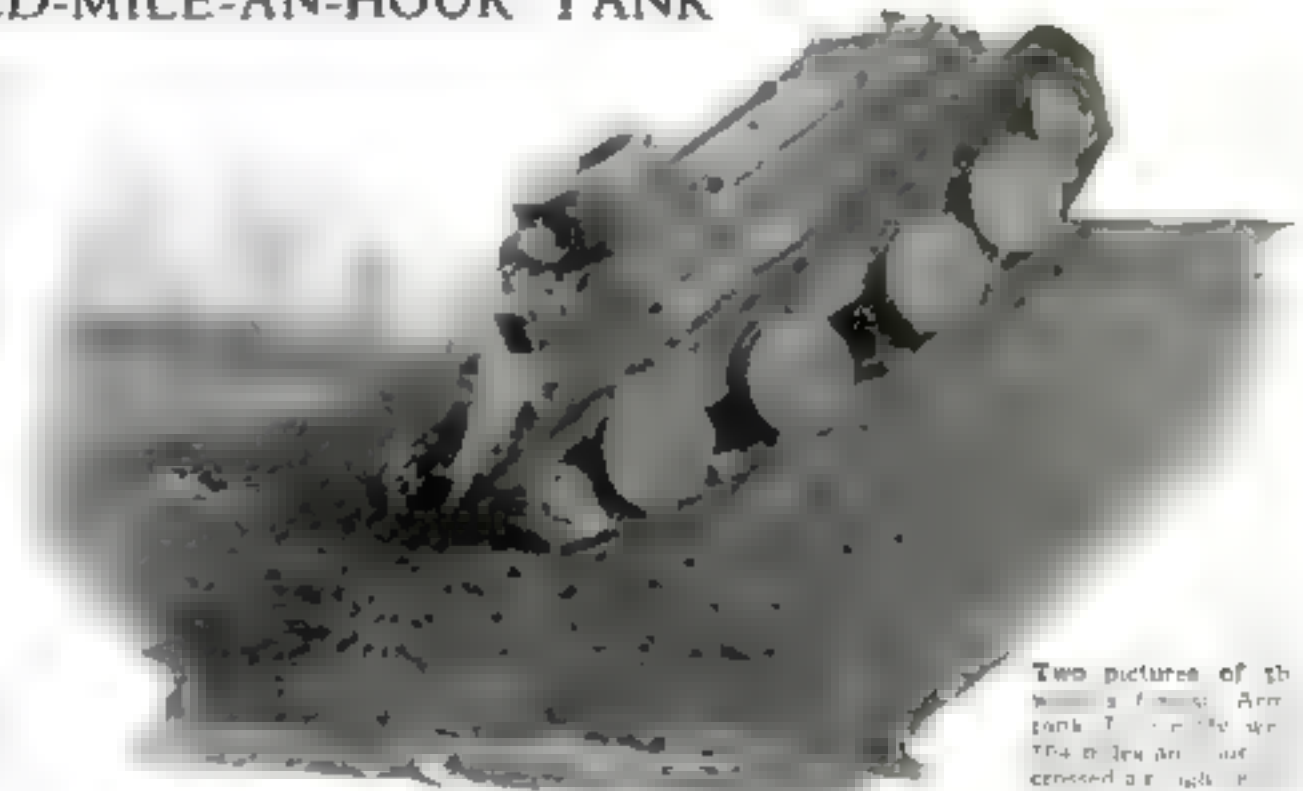
## ARMY SEES HUNDRED-MILE-AN-HOUR TANK

The fastest tank in the world whizzed along a three-mile stretch of macadam highway at Linden, N. J., a few days ago, and Army observers clocked it at 104 miles an hour.

J. Walter Christie, New Brunswick mechanical engineer and inventor of the tank, put it through its paces for Army officials. When he had finished, they announced they would recommend that the Army adopt it.

Opening wide its 338-horsepower Liberty airplane motor, Christie drove his tank at a speed of forty-five miles an hour across a field strewn with logs and rocks and through a brick wall. It climbed a forty-five-degree incline at thirty-five miles an hour.

A one-pound cannon, a machine gun, and five-eighths-inch armor plate are its weapons of offense and defense. The Japanese government has purchased the right to manufacture 100 of the tanks.

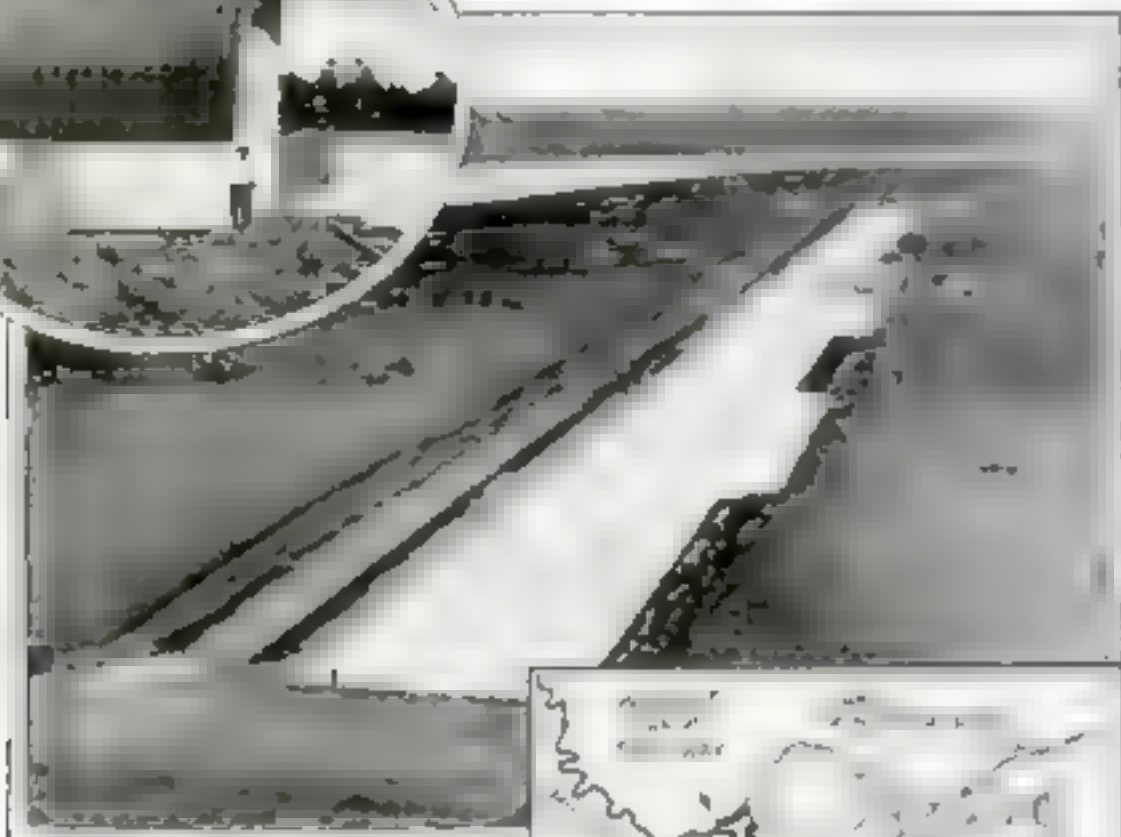
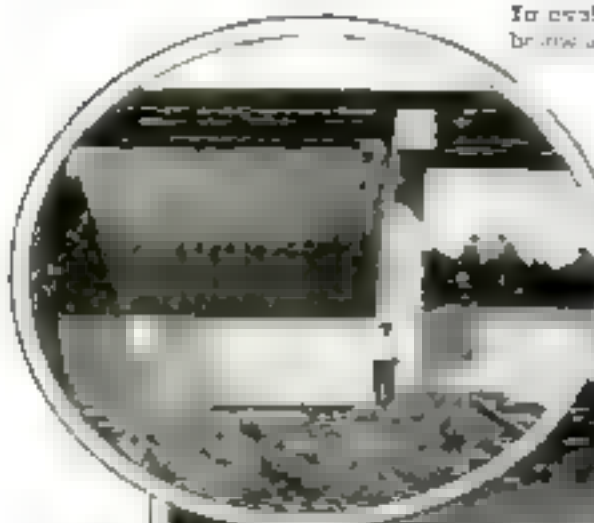


Two pictures of the new Christie Army tank. The one on the left is the tank as it appeared at the time of the test.

## NEW ORLEANS' FLOOD VALVE FINISHED

To deal a blowup of the Carré Spillway and bring an old levee back into normal bearing.

Diagram below shows position of spillway and how it works to let water go back into Lake Pontchartrain.



Twenty-eight miles above New Orleans, engineers have virtually completed a \$3,000,000 safety valve and when the Mississippi is on a rampage, the Bonnet Carré Spillway will be ready for it.

During the flood of 1927, it was necessary to dynamite the levees and flood surrounding country below New Orleans in order to save it. The Bonnet Carré Spillway will divert the waters into Lake Pontchartrain.

When waters reach the six foot level on the dam at the river's entrance to the spillway a traveling crane will race along the top pulling out wooden "needles," or



twelve by twelve timbers that make up the face of the dam. This will let surplus water into the spillway and lower the river level. The newly-completed project is a vital part of the threefold Mississippi flood control program now under way.

## THEATER CHAIR HAS ADJUSTABLE BACK

A new theater seat with pivoted back, recently developed in Seattle, Wash. may prove a convenience to theatergoers. When a belated arrival tries to squeeze into a row of seats, the occupants do not have to rise to let him in. Remaining seated, they push against the back rests of their seats, moving them to a vertical position and increasing the space between their knees and the backs of the seats in front. The new seats take up no more room than those now in use, to which the pivoted back can be attached.

## MATCH LIGHTS 600 TIMES

A new match, devised by a Vienna chemist, can be used at least 600 times before becoming useless. It resembles a woman's lipstick, and is scratched upon its own case. It will not ignite if dropped or trodden upon, and it is practically unbreakable. The composition of the "everlasting match" is secret.



Pushing back in these new theater chairs pulls the knees out of the way so others can pass easily.



## TARANTULA'S BITE FAILS TO KILL

PROFESSOR P. W. FATTIG, curator of the Emory University Museum in Atlanta, Georgia, made a large tarantula from Honduras bite him the other day. The professor said he tried the experiment partly out of curiosity and partly to prove his contention that bites of such insects are not necessarily fatal.

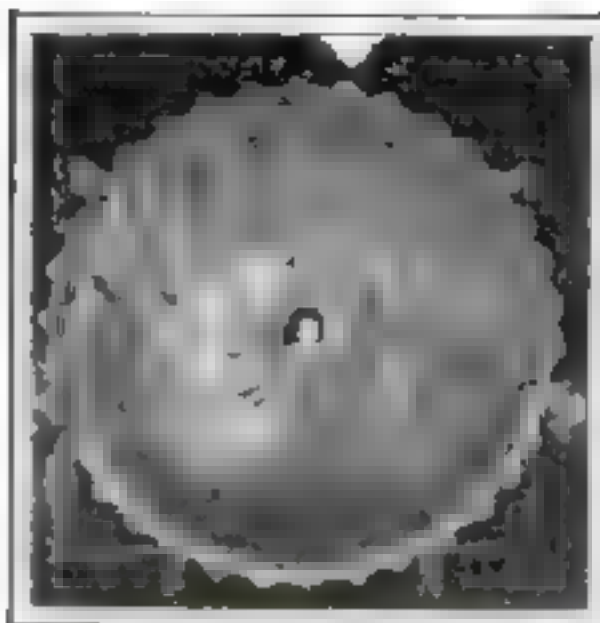
It took about half an hour's poking to make the supposedly vicious creature bite. Then it hung onto the professor's thumb with a bulldog grip for about three minutes before it was pried off. Professor Fattig said the bite was two or three times as painful as a bee's sting and his thumb felt about three times its normal size. There were no other ill effects and the swelling soon disappeared.



## MOTORISTS WARNED TO LOOK OUT FOR PLANES

PLANES swooping in for a landing at the Grand Central Airport in Glendale, California, must cross a motor road at such low altitude as to menace cars. In order to prevent collisions between planes and cars, authorities at the field have erected a highway sign at this point, warning motorists of the danger. The sign resembles those used to warn motorists of their approach to railway grade crossings. This is believed to be the only point in the United States where aerial and highway traffic conflict.





## GIANT "IRIS" COVERS LIGHT MEASURER

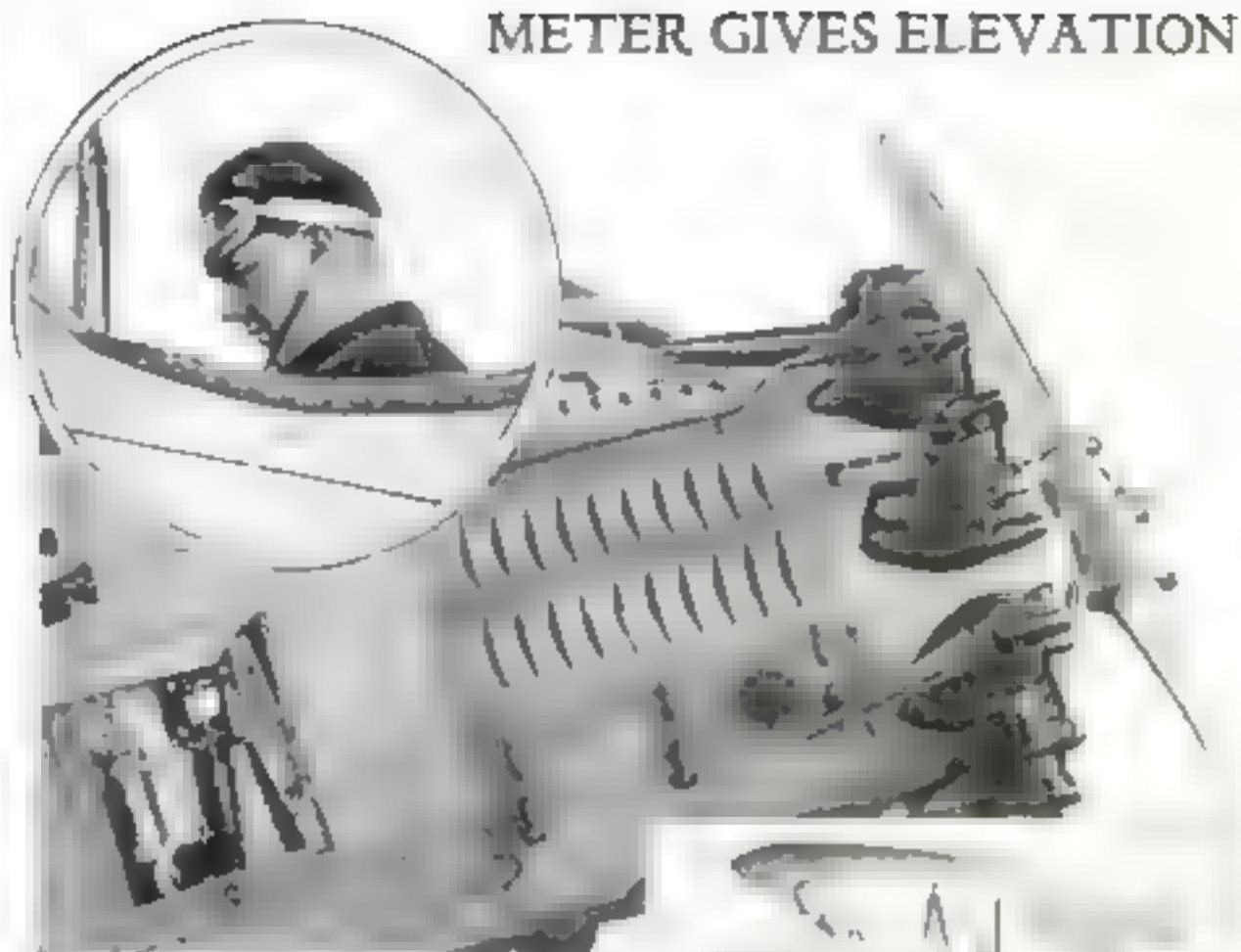
A STRANGE "iris" blooms in the laboratory of an electric company. In design it is strikingly similar to the iris diaphragms with which the lenses of pocket cameras are equipped. It measures nine feet in diameter. Its monster size is evident from the young woman's face in the photograph. The huge "iris" covers a photometer, or "light-meter", that can measure the light output of a billion candlepower searchlight or the tail light of an automobile. A hand wheel adjusts the size of the aperture at the center to let more or less light through. The photometer has been especially valuable in the effort to develop super-searchlights, as with it their power is determined.



## CIGARETTE IS LIGHTED BY SCRATCHING END

CIGARETTES that light themselves without matches have been made before, but this novelty in a new form has just been introduced by a San Francisco manufacturer. Ten cigarettes are packed in a box, each provided with a tip of yellow composition. Scratched like a safety match, upon a special surface of the box, a flare results that lights the cigarette.

A strong wind does not interfere with the lighting, according to the maker. He claims his composition is free of objectionable taste in burning, overcoming the principal problem of other inventors who have sought self-lighting cigarettes.



In circle, Lieut. Albert E. Hegenberger ready to test elevation meter in making blind flight.

an idea from the bats. The Army Air Corps at Fort Monmouth, N. J., and the General Electric Company have developed a device that tells a fog-bound pilot how high he is above the ground.

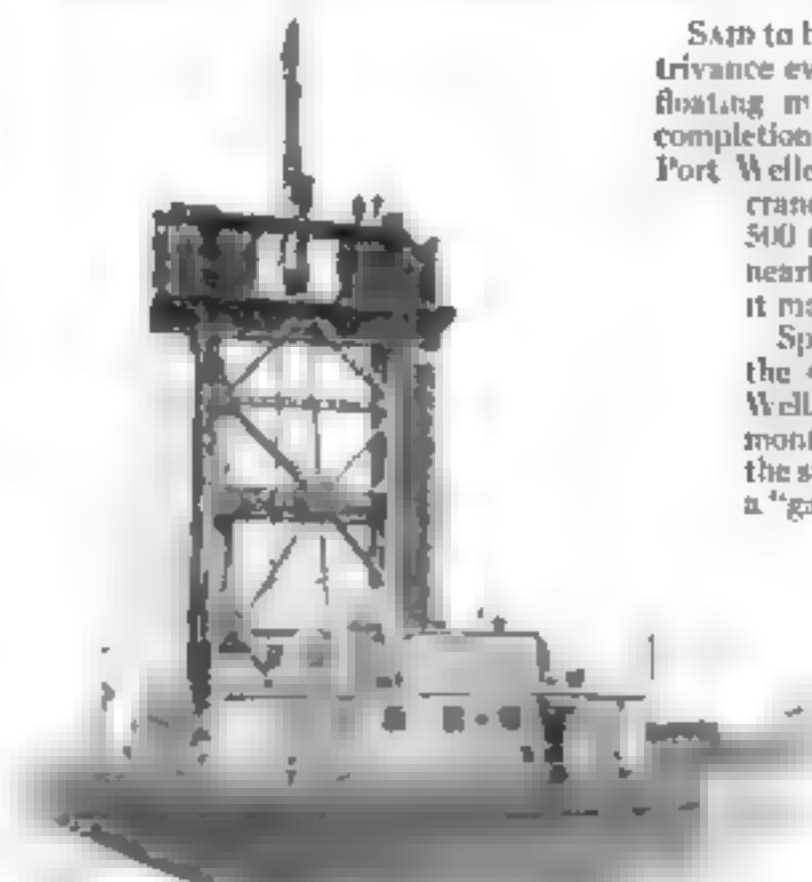
What a high-powered searchlight, aimed back from surrounding objects, enables the animal to sense the nearness of obstacles during his night flights. Taking this idea, the engineers devised a whistle, blown at regular intervals of a second or two by power from the engine of the plane, and a means for catching its echo as it returned from the ground. The time required for this, which measures the altitude directly



In center, the altimeter as it is installed in a plane and diagram showing how the gauge operates.

in feet, is registered on an indicator located on the plane's cowl in front of the pilot. The device was demonstrated recently at Bolling Field, Washington, D. C., by Lieutenant Albert E. Hegenberger, Army Air Corps, who was able to land a plane with its aid while "flying blind."

## BIG GATE LIFTER CAN RAISE 500 TONS



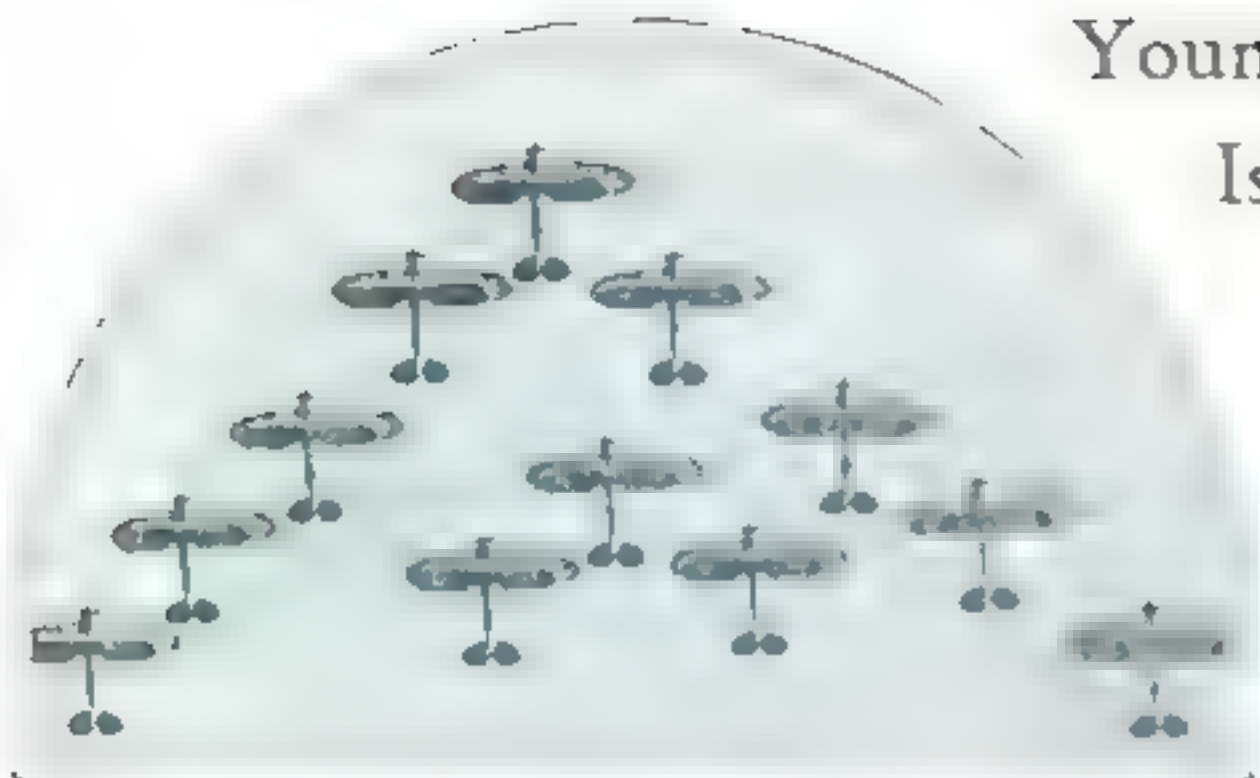
The world's most powerful lifting machine, built for use in case of emergency at Welland Ship Canal, will raise 500 tons ninety feet.

Said to be the most powerful lifting contrivance ever built on land or sea, a huge floating misshapen boat is now nearing completion at the Welland Canal dry docks, Port Weller, Ontario. The 106-foot steel crane it carries is capable of raising 500 tons nearly ninety feet. It cost nearly a million dollars to build but it may never be used.

Specially constructed to pick up the 450-ton lock gates of the new Welland Ship Canal described last month (P. S. M., Feb., '30, p. 62) the strange craft has been christened a "gate lifter" by its builders. It will be used only in cases of emergency, because the lock gates may never have to be removed before they wear out.

The "gate lifter" must be towed since the engines in its squat hull leave no room for propelling machinery. Eight cables each as big as a small tree, can be hooked to a damaged gate when it is desired to lift it.

## Youngest Air Squadron Is Navy's Safest



Striking Eagles, the Navy's crack squadron of the air, won the Herbert Schiff Memorial Trophy as the safest unit in the service. Here they fly in V formation.

"**STRIKING EAGLES**," as fighting squadron VF-3B of the United States Navy is known in naval circles, recently received the Herbert Schiff Memorial Trophy for being the Navy's safest fighting unit. Last year they flew 4,958 hours, representing a distance of almost 600,000 miles, without an accident. The operations of the crack squadron included 861 day and night landings and take-offs from aircraft carriers.



During fleet maneuvers they flew in close and open formations over the

Atlantic and Pacific Oceans and the Caribbean Sea. They repeatedly landed at full squadron strength, eighteen planes, on the decks of carriers at the rate of a plane a minute. Lieutenant Commander Samuel P. Ginder, in command of the squadron during most of the competitive year, received the trophy on behalf of its men.

This prize is offered annually to the safest and most reliable Navy air squadron by the family of the late Lieutenant Herbert Schiff, a naval reserve aviator killed in the line of duty in 1924. Squadron VF-3B, youngest in the Navy, was organized in 1927.



Their planes fly in V formation.



President Hoover presented the Schiff memorial to squadron VF-3B, the trophy being



the youngest in the Navy's youngest squadron. Last year they set a record for efficiency and flew 4,958 hours in the air and flew over the waters of two oceans. They made 861 landings and take-offs this flying year.



# Carving a Mountain Top into a Mighty Statue



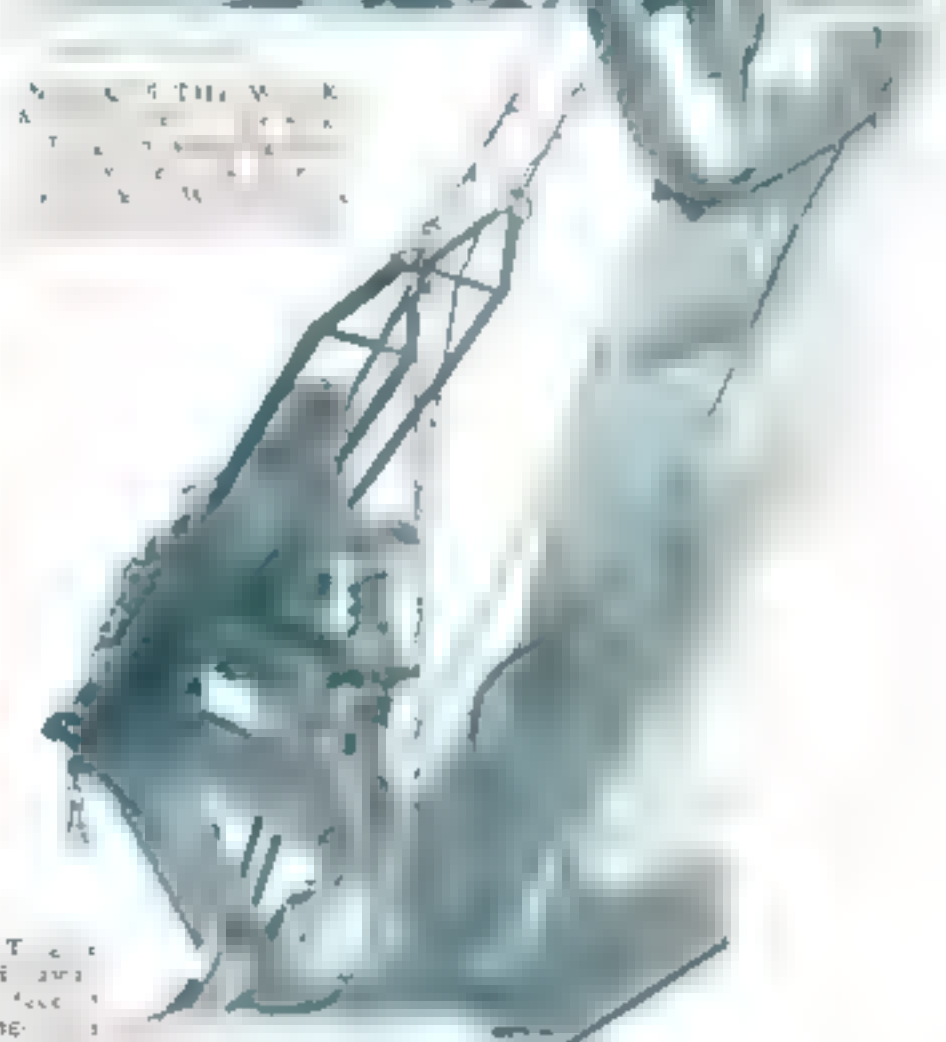
**NATIONAL MEMORIAL IN GRANITE** Out in the Black Hills of South Dakota, Gusun Borglum, above, famous American sculptor is carving out a lasting memorial on the top of the mountains. Here he is seen at work on a model of the group which when finished next year will consist of Washington, Jefferson, Lincoln, and Roosevelt.



**GIANTS IN THE DISTANCE** In the background, at the top of the peak at the right, can be seen the head of Washington, around which the other heads will cluster. Cut upon the loftiest elevation of solid granite between the Atlantic and the Rockies, it is estimated that the memorial will endure 500,000 years. At the right of the heads will appear in carved letters three feet high, a 500-word history of the United States.



**WORKING ON THE MOUNTAIN** The sculptor is seen at work on the granite surface, which is being carved into the shape of the statue's head.



**SADDLED TO CLIFF** The workmen have a chance to drill into the solid granite on the face of a 300-foot cliff. These iron saddles were designed to hold the dynamite which has speeded up the work.

## FOSSIL TREE LINKS AMERICA TO ASIA



Dr. H. E. Collins, of the

North America and Asia.

A BIT of white volcanic rock hardly larger than a silver dollar has just come out of the Arctic to clinch the proof of a great land bridge, which, scientists have long believed, once linked the shores of Asia and North America.

On a tiny dot of land called St. Lawrence Island, in the center of Bering Sea, Dr. H. E. Collins, of the Smithsonian Institution, found this little piece of ancient rock. Embedded in its surface is a small, feathery leaf of *Sequoia langsdorffii*, a fossil redwood tree, almost identical with the *Sequoia sempervirens*, or coast redwood, still abundant in the Coast Range mountains of California.

Its discovery in the center of the Bering Sea, plus the fact that it had already been found on each side shows beyond question, Dr. Collins declares, that the island was once part of a land bridge connecting Siberia with Alaska.



## REGULATION JACKKNIFE IS KNIFE AND FORK

A JACKKNIFE that can be converted into a knife and fork is the product of a New York firm. When taken apart the

handle form separate handles for the knife and fork. Carried in one pocket. It is said that this tool

reduces the number of implements that

are carried in the pocket.

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## BAG FOR VEGETABLES HAS SHOW WINDOW

A SMALL cotton bag with a show window in the rear has been perfected by textile specialists of the U. S. Department of Agriculture. The new bag is intended for use as a container in which stores may sell potatoes, onions, and similar products. The show window feature permits housewives to peer in at the back of the bag and see the size, shape, and condition of the contents without untying the bag's fastenings.

A special weave was necessary to produce a bag that was woven close enough on the front side to allow the printing of the name of the grower and the contents of the package, while retaining the lattice effect in the back of the bag. The bag was designed by R. J. Cheatham, who is in charge of research on new uses for cotton in the Department of Agriculture at Washington, D. C.



## GIGANTIC X-RAY TUBE WORKS FOR MAN

THE great X-ray tube that California Institute of Technology engineers recently completed, after three years of labor, has at last been put to work for humanity.

Dr. Charles Packard, Columbia University biologist, is using its potent rays in his search for new treatments for diseased human tissues. The subjects of his experiments are fruit flies, caged in glass bottles, and white rats in wire cages.

Ten million dollars worth of radium could provide him with rays of no more power than this mighty tube. Because of the extremely high potential at which it operates—more than 6,000,000 volts of electricity—it produces rays resembling those of radium. Described in this magazine (P. S. M., Dec. '30, p. 31), its rays

will penetrate more than two feet of concrete, and a barricade of sandbags helps to protect its operators.

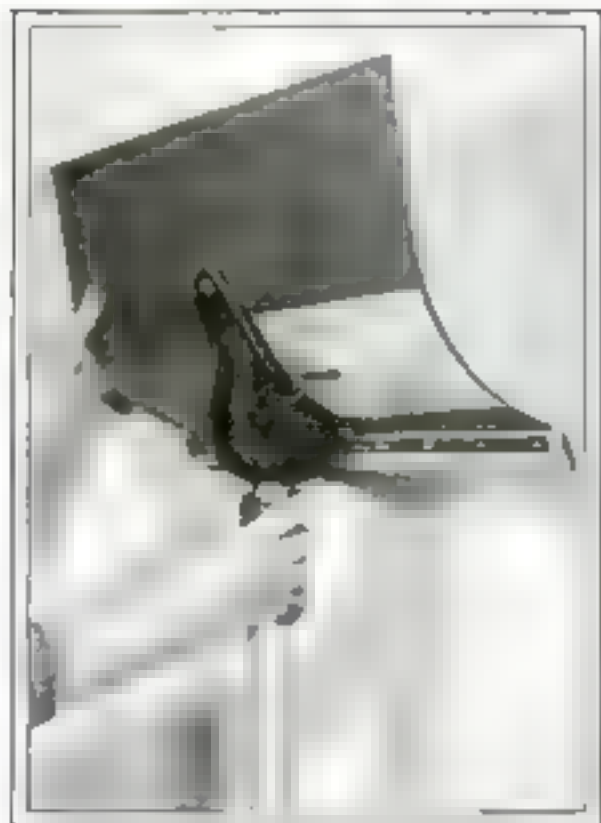
## DO YOU SPELL WELL?

If you make mistakes in spelling, take comfort from the words of Clyde R. Miller, director of educational service of Teachers' College, Columbia University. The brightest students he finds, are sometimes the poorest spellers. When he gave a series of tests in a Brooklyn, N. Y., public school, he found that the cleverest pupils frequently spelled a word according to its sound, rather than in accordance with the dictionary.



Widely spaced mesh on one side of this bag permits a view of the condition of contents.





### SNOW SHOVEL IS ALSO SMALL HAND PLOW

A VERSATILE snow remover recently was placed on the market by a firm in Chicago, Ill. It can be used as an ordinary snow shovel or, by means of an adjustment on its handle, as a small hand plow, for use where snow lies thick and loose.

In removing snow or slush from wooden steps or porch floors, the blade is reversed and a rubber strip along the edge of the blade prevents marring or scratching the painted woodwork. This attachment also makes the versatile shovel a convenient tool for removing water from gutters. They have been used to remove water from roofs or gutters that collect the surplus water.



### COTTON PICKER DOES WORK OF GANG

A STRANGE-LOOKING machine crawled up and down cotton fields at an experimental cotton farm near Stoneville, Miss., recently, doing the work of many laborers in harvesting the crop. Machinery has been tried for this work before, but it has never proved entirely successful. All the cotton bolls—or buds from which the fiber is picked—in one crop do not ripen at once, making it necessary for the pickers

## LABORATORY CELL BEHAVES AS IF ALIVE

While searching for a way to check cancer, Dr. George W. Crile, noted Cleveland, Ohio, biologist, stumbled recently upon a phenomenon so close to the synthetic production of life—long a dream of laboratory workers—that the scientific world is still debating what its significance may be.

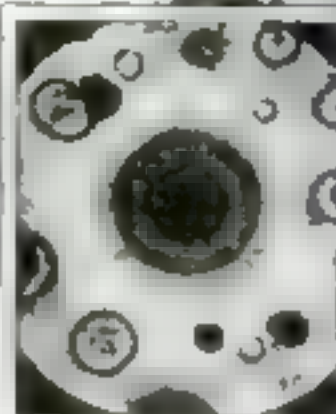
When Dr. Crile extracted supposedly lifeless fat and protein from the brain of a freshly slaughtered animal, and placed it in a solution to which certain salts had been added, strange microscopic organisms appeared which he termed "synthetic cells." This name, he said, described their ability to put themselves together. Not only do they resemble living cells, but they multiply by splitting in two, just as live cells do.

Their reactions to oxygen, and to poisons, are nearly identical to those of the amoeba and other simple living cells. They particularly resemble the cancer cell which grows at the expense of other cells in the human body, and whose only function is growth.

Somewhere in the vague ground between the lifeless and the living is Dr. Crile's cautious description of them. "If news had not leaked out prematurely," he declares, "I would not have discussed this matter for months. Meanwhile



CRILE, M. C. Crile, University of Pennsylvania, has discovered a synthetic cell which behaves as though it were alive.



At left, a microscopic view of a synthetic cell. It is a small, round, clear structure with a dark center, surrounded by a thin membrane.

### GIRL INVENTS WAY TO PUT METAL ON CLOTH

INVENTION in her own right is Natalie Hays Hammond, of New York City, who comes of a mechanical-minded family. Her father, John Hays Hammond, is a famous Washington, D. C., mining engineer, and her brother, John Hays Hammond, Jr., has patented more than 400 inventions in radio and other fields.

Miss Hammond at twenty-four has devised a secret process by which decorative metals can be applied to fabrics for women's dresses—and to other materials as well. Once applied, it is said, they cannot come off. Miss Hammond patented her process, and now has 1,500 workmen in her New York factory.



Miss Natalie Hays Hammond exhibits fabric coated with metal by a process she invented.

# Mercury Turbine Now a Success



*New Power Idea Proves Its Value  
in Practical Use As Quicksilver  
Vapor Spins Electric Generator*

By EARL CHAPIN MAY



**W**HEN in 1914 Walter LeRoy Emmet, General Electric Company research engineer, first suggested that mercury vapor instead of steam could be used to drive a turbine wheel, scientists and engineers scoffed at him.

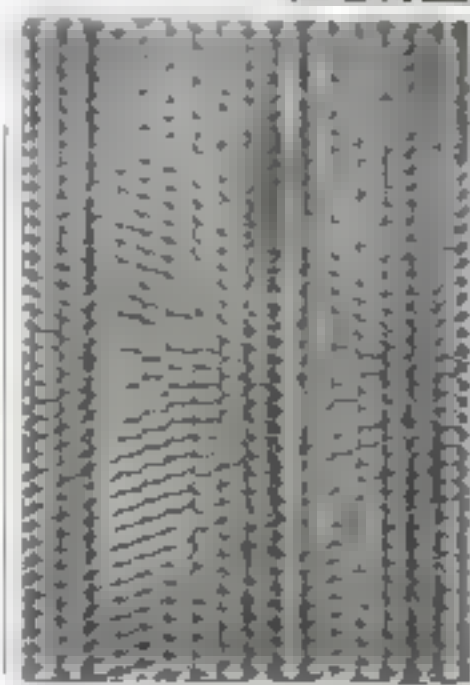
They said that while the physical characteristics of mercury—its boiling point, specific heat, and so on—were theoretically possible, insurmountable obstacles lay in the way of one who tried to work it out in a practical way.

Pointing to the trouble leaks that often occur in steam piping, they said that similar leaks would certainly occur with mercury vapor, which is even harder to contain than steam. Such leaks they claimed would be a waste of valuable mercury and kill all the engineers. In fact, mercury vapor is extremely poisonous.

However, Emmet refused to listen and built an experimental machine. These early tests were described in *POPULAR SCIENCE MONTHLY*.

A few days ago, I saw in operation a mercury vapor power plant of full commercial size that, during the last year, has set a low figure for the use of coal such as the world has never before seen.

This startling result was made possible by the foresight of T. H. Soren, vice president of the Hartford Electric Com-



Looking up at the dead end tubes in which mercury vapor is generated.

pany's Dutch Point power generating station.

During the years that followed, test runs bore out Emmet's theories, but some of the troubles predicted by the scoffers also were encountered.

A boiler head blew out and thousands of dollars worth of the valuable mercury

escaped. Only part of it was recovered. A turbine wheel went to pieces under the strain and caused a shut-down for several months. Workers were overcome by the fumes of the poisonous mercury. There were, however, no fatalities, nor was anyone permanently injured because of the unusual precautions taken by the company to protect the men who had charge of the work.

After Soren, James Orr, the company's superintendent of power, and their assistants had learned all they could from the first experimental plant, a second was built with such changes as experience dictated. This unit gave improved results but also developed some defects.

Then, utilizing the engineering knowledge gained from the years of experimenting with the first two units, the company decided to build a real, commercial size, mercury boiler unit at its South Meadow generating plant.

It was this plant I recently inspected. I had gone prepared to see only experimental apparatus that produced results when it ran at intervals between costly and dangerous breakdowns. I found instead a house unit that was solidly engineered, permanently installed, and running without any sign of trouble. In fact it is now planned to follow the general design of this plant in building a unit twice as large—20,000 kilowatts in capacity, in the new power plant of the Schenectady works of the General Electric Company.

**T**HE South Meadow mercury boiler unit is producing as high as 143 kilowatt hours of electrical energy for each 100 pounds of coal burned. The finest steam power generating plant in operation today produces only 112 kilowatt hours of energy from that much coal. According to United States Government reports, the average efficiency of all the public utility power plants in the country is fifty-nine kilowatt hours from 100 pounds of coal. (Continued on page 47)

General Electric Company to continue the work on a larger

experimental mercury

constructed and installed at the Hartford Electric Company's Dutch





# New Weapons Win in War on Forest Fires

By ROBERT E. MARTIN

**C**ELEBRATING the twenty-fifth anniversary of its existence, the United States Forest Service last year set a record for speedy stopping of forest fires.

In spite of a nation-wide drought that turned the summer woods to tinder, and of the fact that there were more fires than the year before, the loss in the national forests was reduced *eighty percent* and the average area burned was cut from 131 acres in 1920 to less than twenty-five acres in 1930.

Forest fires were stopped in their tracks and few did extensive damage.

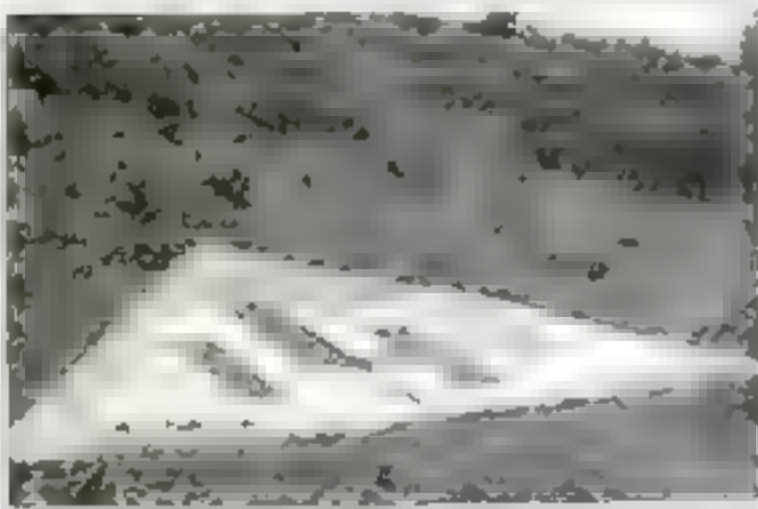
Behind these impressive figures lies a record of continual experiment to adopt the latest scientific discoveries to the work of the forest patrol. The fire fighters today form a mechanized army whose equipment would have amazed even the most optimistic prophet when the service began in 1905.

Airplane loudspeakers, warning campers out of the path of the fire and directing the fire-fighting from the sky; huge tractors, almost as big as war-time tanks, smashing their way through underbrush, plowing fire lines to cut off the advancing flames; small portable radio sets, giving the latest information to workers; large planes, landing in emergency fields cleared in the forests, bringing additional men and supplies. Such are the things now being experimented with by the service.

**I**N THE 14 national parks owned by the United States, there is a total area of 160,000,000 acres, an expanse greater than the whole state of California. A regular force of only 2,700 men must watch over this vast territory. By using the airplane for eyes and the radio for ears, they accomplish the seemingly impossible task.

Last summer a portable radio set rugged enough for the work was developed. This

Formerly forest fire fighters patrolled their districts on horseback, but now their work is speeded up with airplanes, autos, and trucks.



An airplane patrol signs on Timber Mountain, Modoc National Forest, California. The enormous triangle marks an emergency landing field reserved for the flying firemen.



Portable radio set designed by Forest Inspector D. L. Best. It is strong enough to stand transportation into the region threatened by fires.



Left, lookout tower in Ocala National Forest, Florida; above, fire under that determined the exact location of flames.



compact and sturdy instrument was designed by D. L. Beatty, a forest inspector in the Columbia National Forest, in Washington. Complete with batteries, antenna, and carrying case, the combined receiver and transmitter weighs only seventy-nine pounds. The batteries will give a season's service and allow twenty-five hours continuous use of the transmitter.

**M**ESSAGES have been sent and received by the little sets over distances as great as 350 miles. Packed over rough mountain trails on mule back or carried in by men, they have stood the jarring and pounding and have shown no ill effects, in spite of the fact that the vacuum tubes are not removed during transportation.

By the use of this equipment forest rangers are collecting valuable data on the absorption of radio energy by green timber and on the "shadow" effect of mountains.

While some of the lookouts, watching for fires from high mountain peaks, are in touch with the head office only by wireless the radio sets are not designed to supplant the telephone that connects most of the regular lookout towers with headquarters.

In 1905, there were less than 500 miles of telephone wires in the national parks. Today in these parks, there are more than 35,000 miles of wire. The men in the observation towers have telephones at their elbows and at the first sign of fire notify headquarters.

The value of such early reports is increased by the use of a simple device called the "fire finder." A pivoted bar with two upright sights is swung around until it is aimed directly at the smoke rising from a fire. The line made by the bar across the map on which it is mounted is noted by the observer and this information phoned in. Other lookouts make similar observations from different sides of the fire. The intersection of these lines on the headquarters map marks the exact location of the blaze. This knowledge saves valuable time in getting to the fire.

Every minute is precious when a fire begins eating its way into timber. In Colorado, a few years ago, one forest fire raced through 2,500 acres of valuable trees in three hours and a half. Where the fighters used to go on foot or on horse or mule, they now speed to the vicinity

of the fire in automobiles over roads built at strategic points. From a total of about 300 miles of roads in 1905, the mileage of good roads in the national parks had jumped to nearly 17,000 by 1927.

Some of the motor cars are equipped with flanged wheels so that in an emergency they can race over railroad rails to the threatened area.

Gasoline engines have joined the fire fighters in another important way. Huge tractors are being used to break roadlike paths through the underbrush to help the workers make fire lines, and gouge out gaps at which the flames are stopped or at least delayed.

In (Continued)

Page 1



Digging a trench as fire trail and at left on lifting the next step after that is dug.



A force pump drives a stream of water through 700 feet of hose to stop forest fire.



Here is the fire pump in action, drawing water from a creek and forcing it through hose to scene of forest blaze hundreds of feet away.



Fire near Buslaw National Forest in Oregon. Photo taken soon after it started. At right, a smoke cloud above Echo Mountain, California.

# Ugly Green Mold Is Food and Medicine



You would turn up your nose in disgust if offered bread covered with green mold.

By MARSHALL  
ANDREWS

**Y**OU would turn up your nose in disgust if somebody offered you a piece of moldy bread at dinner, yet a half hour later you might eat with relish a piece of cheese, a product of that willsome mold.

Recently scientists have found out much about mold, the strange vegetable growth that can occur in thousands of different forms. They are beginning to discover how to make mold produce materials at little cost that once could be made only by involved and expensive chemical methods.

They have discovered that the famous mildew is poisonous, however deadly it may look. They have found, indeed, that mold properly controlled can be made a valuable factor in promoting human health and happiness.

Mold is so all-pervading that you can not avoid eating it and even breathing it. When you walk up to a soda fountain and order a soft drink chances are you will be served with a cookie or something with an ounce of the most general product of mold.

When you tear off the tin foil at a piece of yeast you are preparing to eat a small cake of a vegetable growth that is food brother to the horrible stuff that festoons stale bread.

If you are a lover of good cheese, your roquefort and camembert will introduce you to forms of mold every time you indulge yourself.

Medically mold has proved an unexpected ally in the treatment of calcium deficiency in the blood, a condition akin to anemia. The thousands who watched the progress of King George V of England in his recent illness and rejoiced at his fortunate escape know that his recovery was hastened by injections of calcium gluconate made by



When cheese mold, the kind that coats camembert, is seen under a microscope it looks like this.

American chemists in Washington laboratories from a form of mold.

In the manufacture of certain fine textile products it is necessary to impregnate fabrics with starch and other chemical agencies to preserve them while they are being woven or knitted and finished articles. Textile mills employ several types of mold to generate enzymes that digest these sizing materials leaving the finished product fresh new and unobtrusive to the harsh ministrations of dyeing machines.

The adaptation of mold to industrial,



Having scorned moldy bread you have no hesitancy in eating mold-cured cheese.

medical, and agricultural uses has come about more or less accidentally. Many of these discoveries have resulted from the efforts of scientists of the U. S. Department of Agriculture to halt ravages of mold upon plant life and foods, costing millions of dollars annually.

Only recently, two chemists of the Department of Agriculture, Horace T. Herrick and Orville E. May, working in Washington to produce lactic acid from milk forms found themselves in possession of valuable knowledge. They made 180 experiments with different types of mold but only to meet with failure in 249 of them. The last produced gluconic acid which aided the recovery of the King of England and which before their discovery was a rare and expensive drug. The importance of their discovery may be understood when it is known that the cost of this valuable salt, under their process of production from mold culture, has been reduced from \$15 per pound to only fifty cents per pound.

The calcium gluconate made from the gluconic acid thus produced from molds, according to the Department of Agriculture, is now regarded as the only calcium salt that can be injected between the muscles of patients suffering from a deficiency of calcium without causing abscesses. It can also be injected into the blood stream or given through the mouth. In the latter connection, the Department issues the reassuring information that calcium salts produced from mold are practically tasteless in contrast to other forms of the drug.

A peculiar thing about molds



Samples of the different types of mushrooms which are just mold.



is that experts, who have spent most of their working lives experimenting with them, cannot state how many forms of mold there are. Mold is a mysterious vegetable, too small to be seen by the naked eye, and appearing in so many forms and in so many places that it baffles even the trained investigator.

**M**OLD comes in every color of the rainbow and in numerous shades of these colors. The same green mold that spoils your bread if you keep it too long is that which makers of roquefort cheese employ in seasoning their product. In fact, mold cultures for the manufacture of roquefort cheese are grown in bread and transferred to the cheese when it is ready to be ripened.

In this regard, mold is a true paradox. Manufacturers of food products spend thousands of dollars annually in an effort to stem its ravages on food shipments. On the other hand, the same manufacturers spend still more thousands of dollars each year nurturing mold to give them, quickly and cheaply, the results which only time can produce without the aid of mold.

Another peculiar fact is that mold, despite its unattractive appearance, is not poisonous. Dr. Charles Thom, of the Department of Agriculture, who has spent twenty-seven years studying mold declares that no poisonous form of mold is known to experimenters. In support of this contention he cites an occasion upon which horses were fed oats in which mold had been permitted to form. Although the oats were thoroughly moldy the horses ate them with apparent relish

and suffered no bad effects whatever.

Some forms of mold are cannibalistic. In growing mold cultures, chemists usually employ such food bases as agar, starches, and other common nutritive agencies. A few molds, however, may be grown upon other forms, consuming their victims and growing fat and happy. These types are described as "predatory."

The care of food products in transit and in storage is a constant fight against mold. Until a few years ago, there was little information



Dr. May watches the growth of mold during the Bureau of Chemistry's efforts to produce gluconic acid.

At the left another form of mold, an oyster fungus growing on a tree.

available which would enable the shipper of foodstuffs to protect his valuable holdings until they had reached their market. Now, however, under advice of the Department of Agriculture, little loss is sustained by producers of food susceptible to attack by mold.

Protection comes in many forms. It was discovered, in one instance, that a new and peculiar form of mold was forming on eggs in transit, rendering them unfit for consumption and causing heavy losses to the producers. After careful study of this problem, it was learned that the eggs were being shipped in crates made of unseasoned wood. The use of fully seasoned crates solved the difficulty.

**O**N another occasion, during the World War, it was found that some 1,500,000 hams stored in Baltimore had either spoiled or become "musty." An investigation showed that in every instance the moldy hams had been "short cured," under permission of the Government, and that those which had been thoroughly cured withstood attacks of mold.

Scientists in the Department of Agri-



H. T. Kerrick, of the Bureau of Chemistry, examines the mold grown in glucose solution.

culture who have studied mold for many years say that the average household refrigerator is no protection against formation of this parasite. Mold colonies, they say, will form readily enough in the temperature of fifty degrees Fahrenheit. In fact, one case is brought out in which beef, in overseas shipment, formed mold spots at twenty-two degrees Fahrenheit, or ten degrees below freezing.

**R**EFRIGERATION, it seems, only delays formation of mold. Yet mold cultures have been kept for as long as twenty-five years under refrigeration by Department of Agriculture chemists. Again mold proves a paradox.

Everyone knows that foodstuffs kept long enough in a house will become moldy. Furthermore, anyone who has seen jelly made and sealed in glass jars may wonder why mold so often is formed on top of the jelly while it is being kept. The answer of the scientists is that mold is everywhere, in the air, in the earth, and on everything with which the food product may come in contact. If you want to prevent mold from forming on jelly, sterilize the glass and seal it hermetically.

Another example of the constant presence of mold in the air is found in two cases of asthma recently traced to mold sensitiveness. The latest case was reported to the American Medical Association by Dr. Harry S. Bernton, of the Georgetown University School of Medicine, Washington, D. C. Dr. Bernton's patient was a young woman who had lived for six years in a damp and musty house, in which it was decided that her nose and throat linings had become sensitized to the particular type of mold that caused her trouble.

Although only two cases of asthma caused by mold have been found in America, many have occurred in Europe and American physicians are now giving much attention to mold as a source of asthma. Dr. Bernton studied no less than sixteen forms of mold in tests upon asthmatic patients in an effort to discover the cause of their condition.

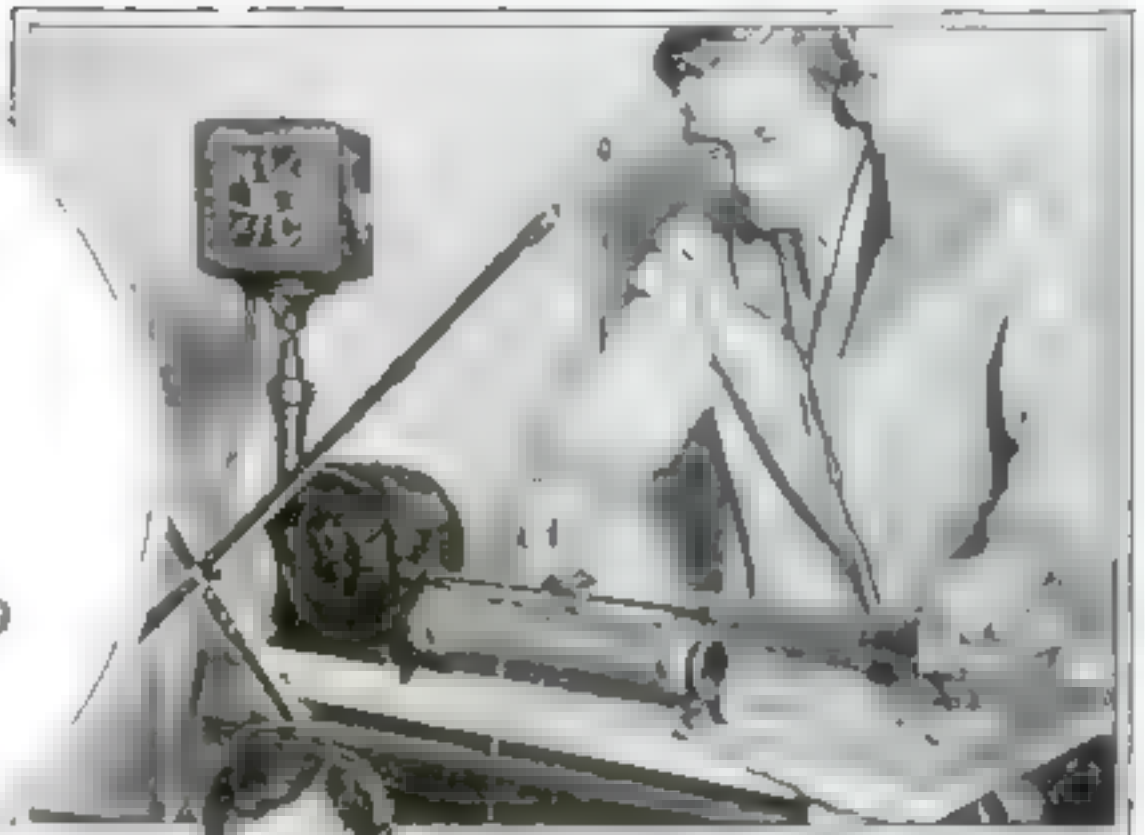
The constant presence of mold in the air is further attested by the fact that factories

(Continued on page 141)



Dr. O. E. May, of Bureau of Chemistry, Department of Agriculture, tests mold growth.

*Strange  
Devices Make  
Realistic  
Noise for Radio  
Audience*



A NEW TYPE OF SOUND EFFECT GENERATOR, WHICH CAN BE USED FOR THE PRODUCTION OF ANY SOUND EFFECT, IS SHOWN HERE.



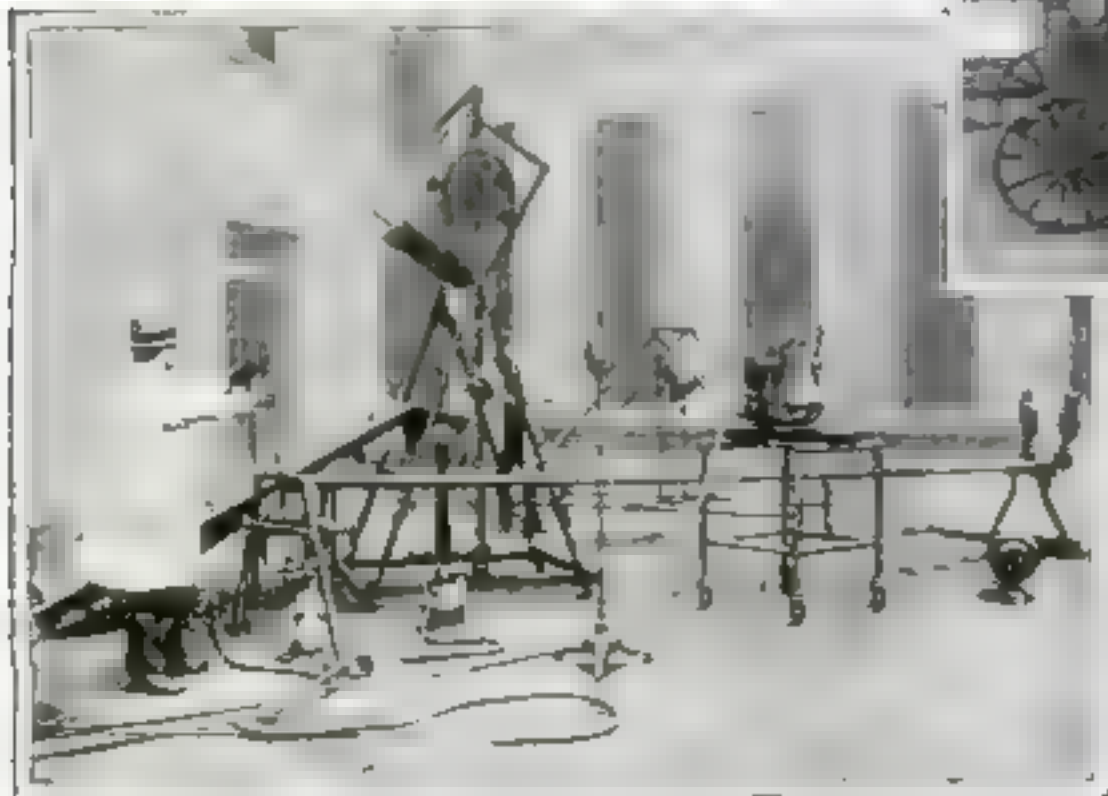
THE SOUND EFFECT GENERATOR, WHICH CAN BE USED FOR THE PRODUCTION OF ANY SOUND EFFECT, IS SHOWN HERE.



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## NATURALIST, POSING AS CACTUS, SNAPS DESERT ANIMALS

NO SHERLOCK HOLMES of fiction ever disguised himself with more versatility than Arthur N. Pack, president of the American Nature Association. When this well-known naturalist wants to approach timid animals in their native haunts, without frightening them out of range of his camera, he dons an appropriate costume.

A disguise resembling a giant desert cactus was his creation during a recent expedition through the desert wastes of Arizona along the Mexican border with William L. and Irene Finley, noted naturalists. Chat his shy desert animals wa ked up to him to be photographed.

Mountain goats, among the most difficult of wild animals to approach, were successfully photographed by Pack. He fashioned for himself a white goat costume with horns and long whiskers.

Pack's use of disguises was suggested by natives of central Africa who creep through the tall grass, wearing a wooden mask carved to resemble a bird. Pretending to stop and peck from time to time, the hunter can approach birds and other game close enough to capture them.



## ARTIFICIAL AIR TO AID DEEP-SEA DIVERS

When the *U.S.S. Albatross* was in the Mediterranean for a cruise, it was the first time that the *Albatross* had been in the Mediterranean since it was built. The *Albatross* was the first of the *Albatross* class of submarines, and it was the first of the *Albatross* class to be built. The *Albatross* was the first of the *Albatross* class to be built.

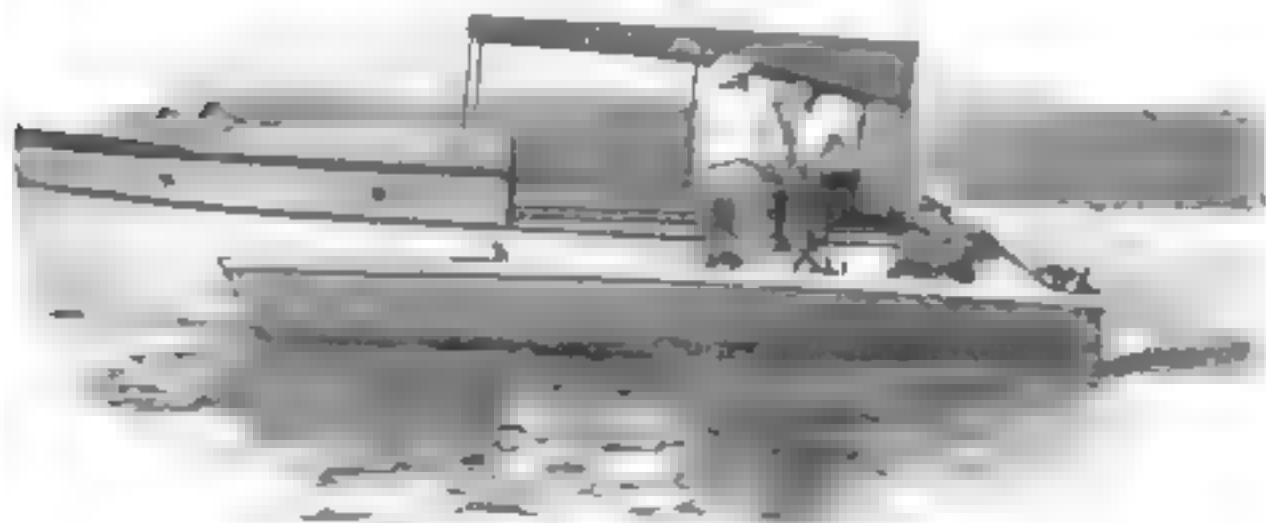
was interrupted when an explosion wrecked the *Albatross*. The *Albatross* was the first of the *Albatross* class to be built. The *Albatross* was the first of the *Albatross* class to be built.

This synthetic atmosphere is the invention of Dr. Wallard Hershey, of McPherson College, Kansas (U.S.M. Apr. 10, p. 32). It consists of an artificial mixture of oxygen and helium, which does not produce bends as does ordinary air.

## 662-HOUR RUN, RECORD FOR OUTBOARD MOTOR

Two outboard motorboat pilots, O. E. Ellison and L. F. Walker, recently drove their tiny craft around Lake Bradford, Tallahassee, Florida, for nearly twenty-seven and one half days without stopping. Purring along for 662 hours, it finally exceeded by fifteen hours the airplane endurance record established by Dole Jackson and Forest O. Brine, of St. Louis. It is said by outboard experts that this represents ten years of average life for one of these portable motors.

A number of such runs were made in different parts of the country. The data will be used in designing new engines.



In this outboard motorboat, O. E. Ellison and L. F. Walker circled around Lake Bradford, Tallahassee, Fla., for 662 hours without stopping the engine, thus setting a new record.



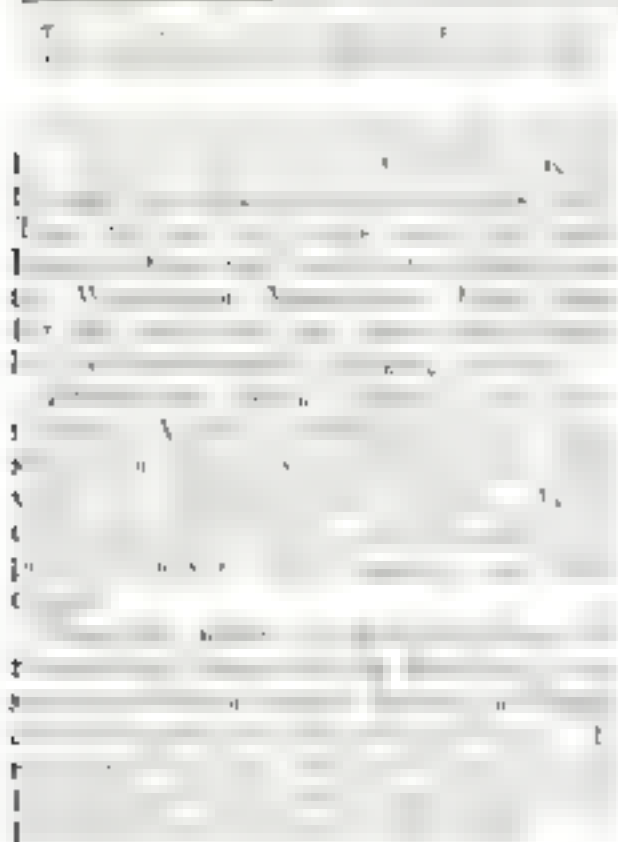
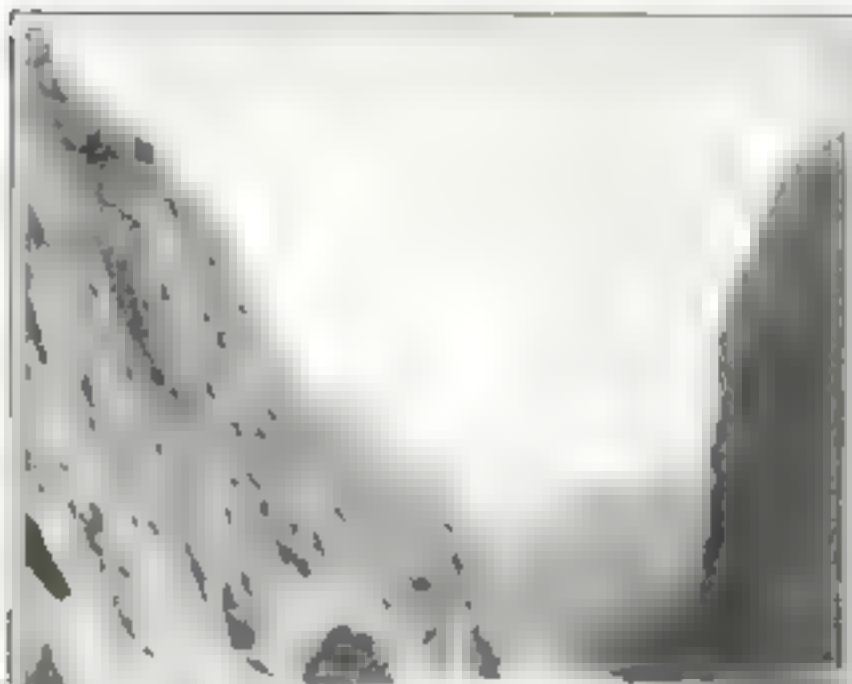
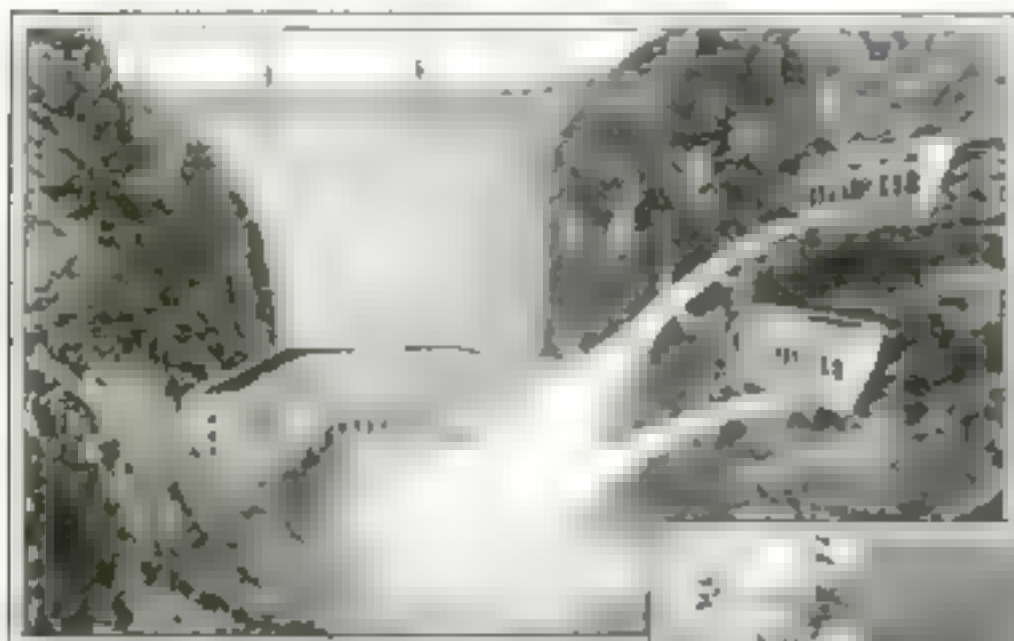
## EMERGENCY BRAKE FOR CARS IS AUTOMATIC

AN AUTOMATIC emergency brake for autos has been designed by W. J. Obidine, garage owner of Los Angeles, Calif. Accidents caused by the failure of the regular brakes at critical moments led him to make experiments that resulted in his device, which consists of a tube system connected with the manifold and a piston cylinder to motivate the brake.

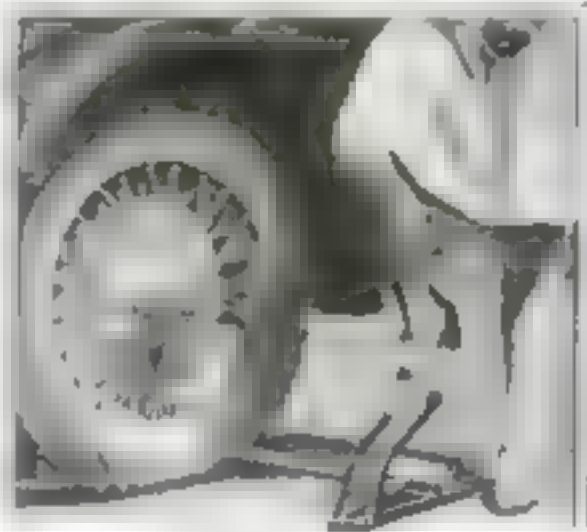
As long as the regular brakes work, the emergency brake does not function, but if they fail, the pedal pressed to the floor touches a valve button that actuates the emergency brake, which can be set to bring the car either to a slow or abrupt stop. Pressing the valve automatically works this brake.

In the picture above Obidine is holding the valve button between right thumb and finger and pointing to the piston cylinder with his left hand. The brake, the inventor says, can be installed in any car equipped with hydraulic, air or mechanical brakes.

## WORK ON WORLD'S HIGHEST DAM MAY START THIS SUMMER



### FOOT PUMP FOR AUTO HAS TWO CYLINDERS



By giving this foot pump two cylinders, dividing the pressure, its operation is easy.

A new type of pump operated by foot power is now on the market for motorists. Power is applied to its plunger by an angular foot lever mounted on one side of the pump frame.

Instead of compressing air in one cylinder, this pump draws it into a large cylinder, partly compresses it, and then passes it into a smaller cylinder, but completes the compression from which it goes to the tire.

The pistons of both cylinders are mounted on the one plunger. Dividing the work of pumping into two stages like this makes it easy for women drivers to pump up the heaviest tires.

The pump is equipped with a push-on connector that fits all valves, and attached to its tube is a pressure gage through which the air must pass on its way to the tire.

## SIX WATERSPOUTS ALL ACTIVE AT ONCE

When a storm is raging over the sea, the waterspouts are often seen. To see even one waterspout is rare, rather to see six working at once.

It is a vortex of sucking air, moving at high velocity, the point of which touches the water and sets it in motion.



One of the most remarkable photographs ever made shows six big waterspouts all whirling madly at the same instant. The picture was taken during a storm in the Swiss Archipelago.



# Winners in December "What's Wrong?" Contest



Judging the entries in *Popular Science Monthly's* successful "What's Wrong?" contest was a big job that required the attention and labor of skilled and diligent judges. Each letter in which the mistakes in the pictures were listed was given careful consideration and checked against the actual mistakes to make sure that each contestant received just co.

**FIRST PRIZE 500 DOLLARS**

C. K. Holsinger, Emporia, Va.

**SECOND PRIZE 100 DOLLARS**

Mrs. C. R. Kenyon, Adams, Wis.

**THIRD PRIZE 50 DOLLARS.** Gerald H. Denison, Detroit, Mich.

## TEN PRIZES OF TEN DOLLARS EACH

G. L. Brewster, Evanston, Ill.  
Edwin G. Cook, New Lisbon, N. J.  
William Geer, Pueblo, Colo.

F. D. Haines, Dutton, Minn.  
Albert H. Hainsworth, Wicketford, R. I.  
Frank Harvey, New York City, N. Y.  
Otto Kroeger, Jefferson City, Mo.

Ruth B. MacArthur, Long Beach, Cal.  
E. L. Moorhead, Pearl Harbor, T. H.  
H. R. Streaker, Los Angeles, Ca.

## FIFTY PRIZES OF FIVE DOLLARS EACH

Mrs. K. E. Anderson, Bowling Green, Ky.  
E. C. Barker, Wilmore, Ky.  
H. W. Baxter, Davenport, Iowa.  
Joseph A. Bieke, Detroit, Mich.  
V. E. Bock, Waterloo, N. Y.  
A. P. Burns, Worcester, Mass.  
Hyman Burwick, Worcester, Mass.  
Monroe Carlton, Ellingham Falls, N. H.  
Mrs. John Chihuly, Jr., S. Prairie, Wash.  
Shelby L. Davies, Portland, Ore.  
R. A. DeLadurantaye, Detroit, Mich.  
Chas. E. Eck, Highland Park, Mich.  
Roscoe Farnsworth, Cecilville, Cal.  
J. H. Field, Fayetteville, Ark.  
R. P. Glenn, Aldene, Tex.  
A. L. Hammond, Haverhill, Mass.  
W. T. Harding, Philadelphia, Pa.

A. E. Heatherington, Orlando, Fla.  
William F. Hibbard, Weiner, Ark.  
Charles D. Hud, Washington, D. C.  
Daniel L. Hugley, Nixon, N. J.  
Leonard C. Houser, Pagosa Springs, Colo.  
Walter J. Irvin, Jr., Reidsville, N. C.  
Harry Jensen, Fort Dodge, Iowa.  
Harold L. Johnson, Shavertown, Pa.  
Harry Johnston, Detroit, Mich.  
S. C. Kenyon, Flint, Mich.  
Glenn W. Knight, Rock Island, Ill.  
W. F. Krentel, Shreveport, La.  
Eva M. Linscott, S. Lancaster, Mass.  
F. J. McDonald, Norwalk, Cal.  
Lena Jane Merrill, Wood, S. D.  
Edward L. Milgate, Utica, N. Y.  
E. Morgan, Chicago, Ill.

James C. Phelps, Port Jefferson, N. Y.  
F. G. Piepenbrink, Ft. Wayne, Ind.  
B. M. Plaskett, Hollywood, Cal.  
Harold W. Readon, Anderson, Ind.  
Robert Rippe, St. Louis, Mo.  
C. S. Robinson, Atlanta, Ga.  
E. R. Roeske, Valders, Wis.  
E. H. Rust, Denver, Colo.  
Z. Sekine, Los Angeles, Cal.  
A. H. Seymour, Lincoln, N. H.  
Vernon B. Shipley, Neodesha, Kan.  
William Stachowiak, South Bend, Ind.  
Syd. Verts, Stuart, Fla.  
S. Wallwork, Athol, Mass.  
W. F. Wessel, Hampton, N. J.  
A. D. Zimmerman, Blue Mound, Ill.

## Final List of Contest Prize Winners to Be Published in April

FROM every state in the Union, from the island possessions of the United States, and even from Australia entries have poured into the office of *POPULAR SCIENCE MONTHLY* during the final days of the great George Knowitall "What's Wrong?" contest. The ludicrous blunders of the well-meaning George in his attempts to show his friends "how to

fix it" have provided fun and profit for a host of our readers.

The interest aroused by this unusual contest is proved by the flood of entries coming from cities, villages, farms, and even from battleships on the high seas. Letters of appreciation for the enjoyment which these brain-teasing pictures have given have been received from many who

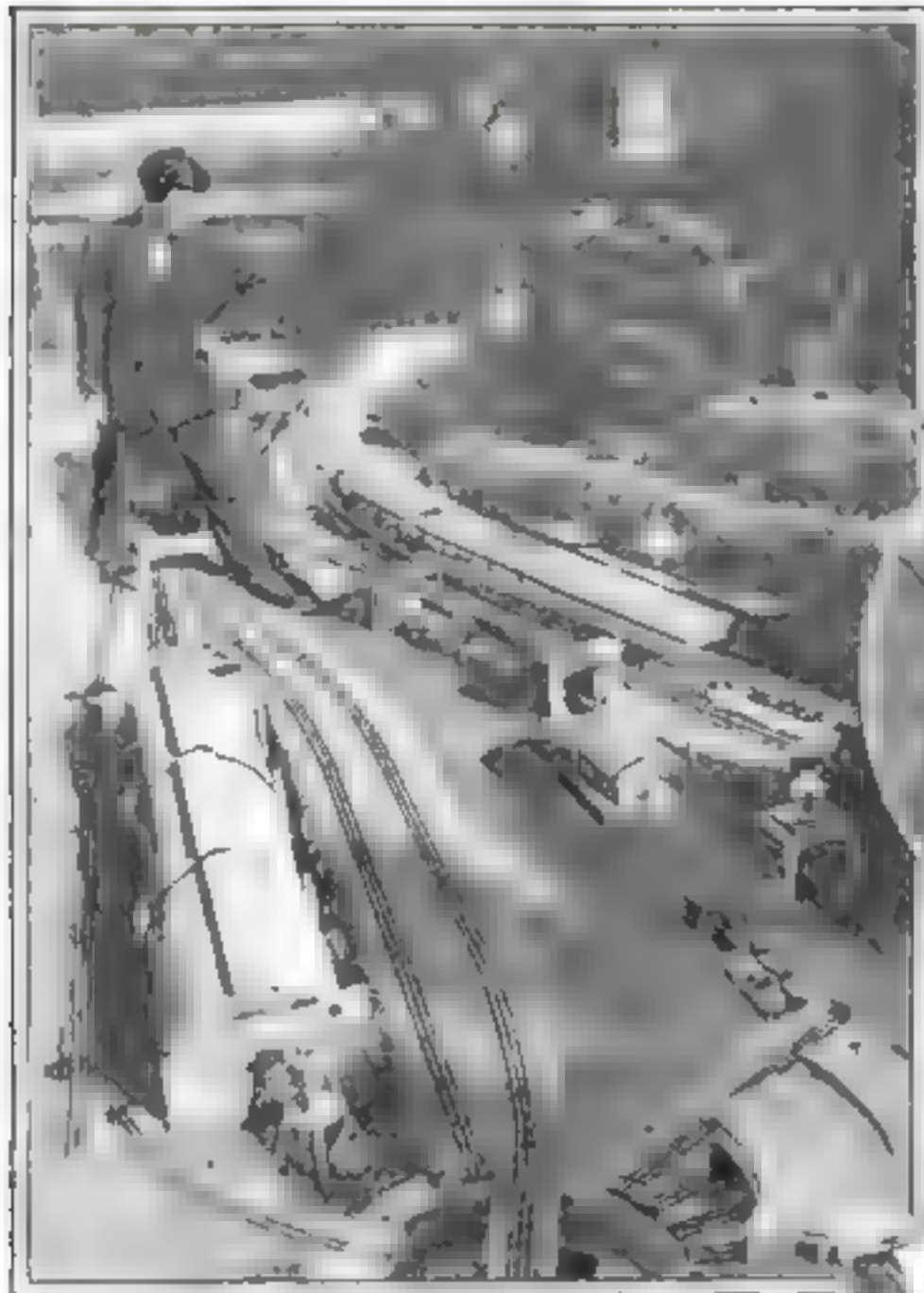
did not enter the contest for one of the many cash prizes, which totaled \$4,000.

The winners of the cash prizes in the December contest are given above. The results of the January contest will be published next month. Watch for the April issue of *POPULAR SCIENCE MONTHLY*. It will carry good news for those who have followed the adventures of George.

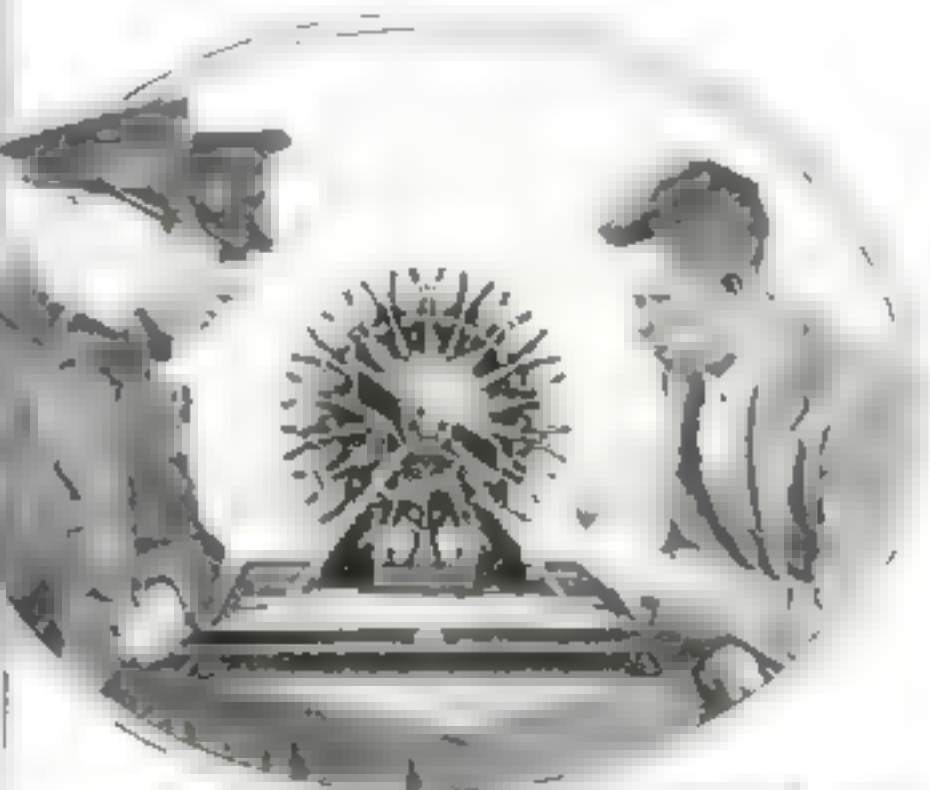




## New and Rare Triumphs Won by Model Makers



**A RAILROAD TRIUMPH** Model made by J. Martin of Walsingham, England, has made a train which he claims is the smallest ever built.



ONLY  
ONE  
OF  
THE  
SMALL  
MODELS  
ON  
THE  
PAGE



**WORLD'S SMALLEST TRAIN** With gold parts so tiny as to be barely visible to the naked eye, J. Martin of Walsingham, England, has made a train which he claims is the smallest ever built.



**PIONEER DAYS BROUGHT BACK** This miniature log cabin, with rail, fence and ox-drawn plow, was built by Adam O. McNattin, of Columbus City, Iowa, and is of soap and dough.

Akron, O., radio tower, 221 feet high, is first of the transmitting set.

## RADIO TOWER SERVES AS BROADCASTING AERIAL



A 221-foot broadcasting tower recently erected in Akron, O. may be the forerunner of better radio programs. Unlike other radio masts, it does not support one end of a system of wires but is itself the antenna.

The height of the tower is carefully proportioned to the length of the wave emitted by the station. Each of the four legs of the tower rests on a base made of steel and special eight-foot porcelain insulating tubes. The legs in a steel tower are not always electrically perfect. The "radiating" tower is assisted in its broadcasting of signals by four vertical wires hung from the top.

They are carried on a crosspiece which may be moved up or down in order to "tune" the tower to exactly the right wave. Instead of absorbing and wasting some of the station's power, as ordinary masts do, the new one puts it all to work.

Following the success of this tower designed for the Akron police department it is reported that one of the large broadcasting systems is erecting a 600-foot "radiating tower" in New York.

## NEW MICROSCOPE PRYS INTO SECRETS OF CELL

A microscope that reveals details of cell structures never before seen is the invention of Charles Spierer, a Swiss scientist. Light is directed downward onto the object from a tiny mirror of gold or platinum on the upper side of the lowermost lens. From the object the light is reflected back to the observer's eye.

## MOTORBOAT DRIVEN THROUGH FLAMES

Residents of Miami, Fla., were treated the other day to the unusual spectacle of an outboard motorboat leaping through flames. Roaring across the bay to get a good start, Malcolm Pope pilot headed his craft straight at a blazing framework mounted on a float anchored off Miami Beach. Going at full speed the boat leaped into the flames and shot out on the other side. Neither the driver nor his craft was harmed by the fiery ordeal.



Malcolm Pope of Miami, Fla., as he appeared at the instant his motorboat plunged from the flames into which he had driven it.



## MOTHER INVENTS MARBLE SHOOTER FOR SON

HER son's torn stockings from kneeling to shoot led Mrs. Nora D. Payne, of New York, to invent this automatic marble shooter which resembles the gear-shift lever of a car. A marble is placed in the receptacle at its base and shot out when the handle is tapped.



## NAVY CLOCK IS HIGHLY ACCURATE

How would you like a watch or clock that wouldn't gain or lose more than one hundredth of a second each day? The United States Navy recently obtained an electric clock accurate within these limits for its Washington, D. C., observatory.

A wooden case resembling those used for old-fashioned grandfathers' clocks has three clock faces on its upper part. Below these a pendulum swings, in step with a master pendulum in a vacuum tank at the right. Working the pendulum in a vacuum insures greater accuracy in its stroke, as there is practically no air resistance to cause variation.

This amazingly accurate time recorder will be used

by astronomers working at the observatory, and will keep time telescope observations by which astronomers are so

The photograph shows Paul Seidenberger, Chief of the observatory's time service, inspecting the precise clock.

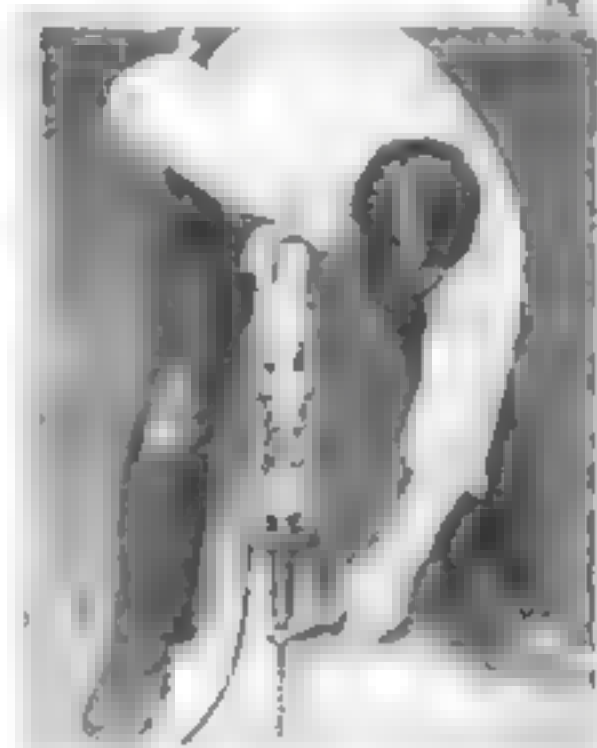


Its pendulum swinging in a vacuum, the clock is accurate to within .01 second a day.



## DRILL CUTS WOOD OR STONE

A PORTABLE electric drill developed by a Chicago, Illinois, manufacturer, cuts holes in wood, metal, or concrete. It uses ordinary twist drills for wood or metal work, and "star" drills for cutting holes in masonry. An attachment used in connection with the star drills gives the tool an up and down hammerlike motion as well as a rotary one. Holes up to seven eighths of an inch in diameter can be cut in concrete, brick, or stone.



The portable drill shown above is being used to bore in concrete. It will also cut stone.



Being a versatile tool, the drill above can drill into wood as easily as into concrete.

## SAND BOX ON BUMPER MAY END SKIDDING

AN INVENTION to take the skid out of driving has just been made by C. W. Northquist, of Minneapolis, Minn.

The apparatus consists of a combination hopper and front bumper, filled with sand, so designed that it can be forced either from the steering post or by pressure on a foot pedal, thus spraying a column of sand in front of the front wheels.

Dry sand is placed in the hopper which is divided by a vertical partition into two parts each of which supplies sand for one front wheel. The bottom of the hopper slopes downward from the center. The vibration of the car causes the sand to flow toward the delivery spouts.

## MODELS OF PIGS HELP BUYER PICK GRADE

WHAT kind of pig will you have? Live-stock buyers can take their choice from clay models made by Mrs. Jeanne Warner, an artist in the Department of Agriculture. Each clay pig represents one of the six different grades of such animals established by the Government for the guidance of dealers. The Department grades pigs as prime, choice, good, medium, common and cull.

The painted models of the sand leave no doubt as to what the Government means by a "prime," "choice," or "good" pig. Twenty-five sets of these models have been shipped to dealers throughout the country. Agricultural colleges have asked for sets as an aid in classroom work.



## AIR CURRENTS CAUSE DUST LINES ON WALL

HAVE you ever wondered why dust collects on the walls along the lines of laths and joists behind the plaster? Professor William J. Hooper, of Battle Creek College, Mich., found that the spaces between laths are usually a little hotter or colder than the plaster. This difference in temperature affects the movement of air currents on the surface of the plaster. If all parts of wall and ceilings were kept at the same temperature no lath marks would occur.

## PLANS TWO ELEVATORS FOR ONE SHAFT

How office workers of the future may ride to and from their places of business is shown by the model of a two-car elevator shaft constructed by Doctor Frank J. Sprague, well-known electrical engineer and pioneer elevator designer. Passengers for upper floors will take a car that runs ahead of the local car, which carries passengers for lower floors only. Separate crums and cables will hold the "express" and "local" cars independently, passengers boarding the "express" on the first floor and the "local" on the sub-basement.

The two-car elevator is like a railroad with express trains running ahead of the locals. Electric safety devices patented by Doctor Sprague will keep the two cars from crashing together or overspeeding. Sprague's safety device is also designed to stop the car and hold it suspended so it cannot fall in case the cable operating either express or local breaks. This plan, it is said, will save space now devoted to elevator shafts in tall buildings.



Dr. Frank J. Sprague, New York, exhibits his special elevator shaft designed for two cars.

## SOAP BUBBLES TEST PLANE'S STRENGTH

GOVERNMENT airplane research engineers at Washington, D. C., recently hit upon the idea of using soap bubbles for testing the strength of plane parts. An opening the exact size and shape of the part under test is cut in a thin metal plate. Using a small wooden tool, engineers sweep a thin soap film over the hole as the plate is held between two metal forms. A light pressure of air is then applied under the film, blowing it up slightly over the hole.

It has been found that the contours of the bubble formed over the opening correspond closely to the twisting effect the

airplane parts are subjected to while in flight. Thus careful measurement of the shape of the bubble gives a good idea of the strength of the part under observation.

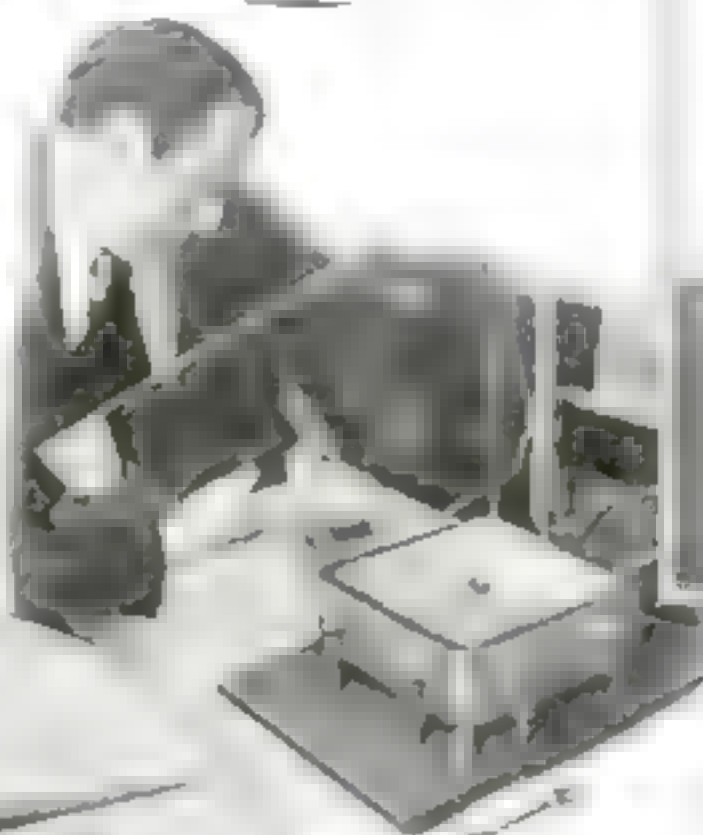
## NAVY GETS AUTOGIRO

THE Navy's next patrol and observation plane may be an autogiro. One of these "flying windmills," similar to those described on page twenty-eight of this issue, was recently demonstrated before aviation officials at Bolling Field, Washington, D. C. As a result, the Navy Department announces that it plans to buy one of them for tests.

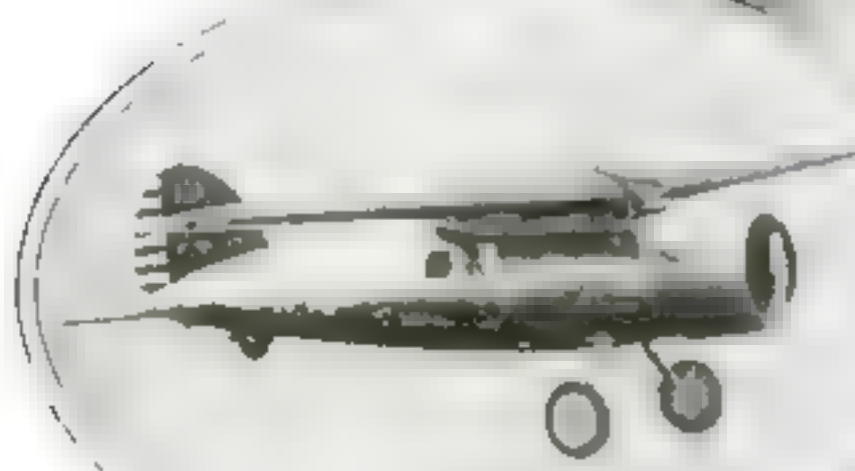
## FASTEST ARMY PLANE HITS 208-MILE CLIP

EXPERIENCE gained in constructing the planes used by Miss Ruth Nichols and Captain Frank Hawks on their record-breaking transcontinental flights has enabled a Detroit, Mich., aircraft manufacturer to build a new speed plane for Brigadier General J. E. Fechet, chief of the United States Army's air forces. Said to be the fastest Army plane in this country, the new speedster made 208 miles an hour in trial flights.

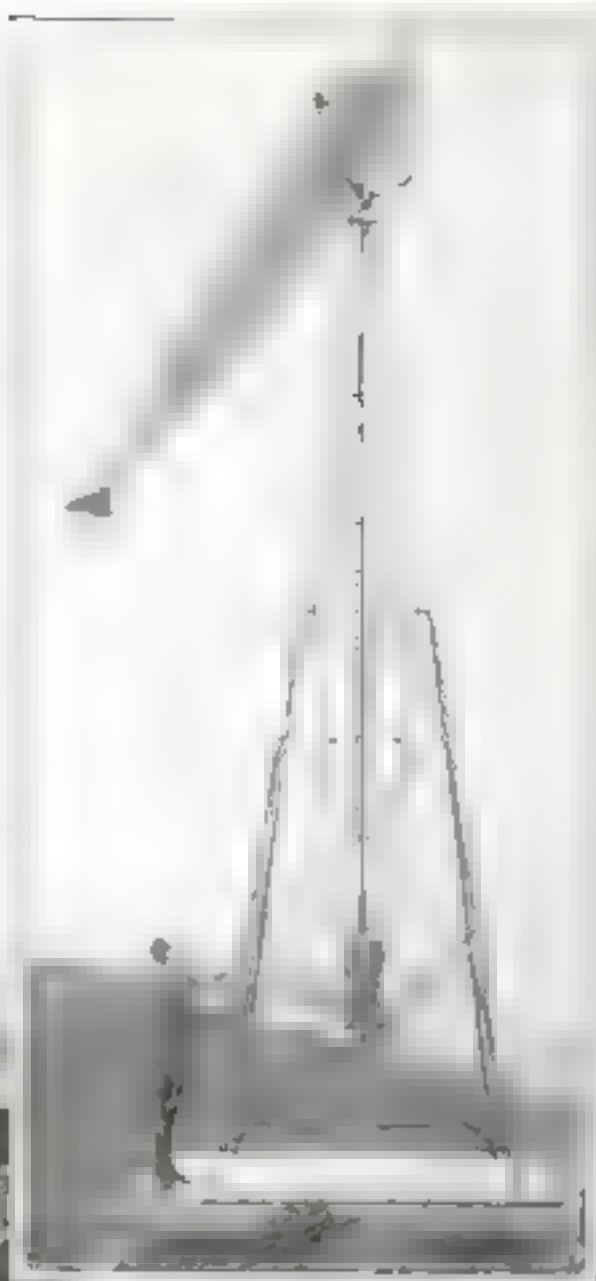
It is a cabin monoplane with the cockpit at the center of the wing.



Measurement of a soap bubble raised over an opening exact shape of a plane part to be tested shows twisting strain the part meets in flight.



Left: Army's new speed plane which in tests made 208 m. p. h. an hour and is rated for a type



## WIND INDICATOR LOOKS LIKE ZEP

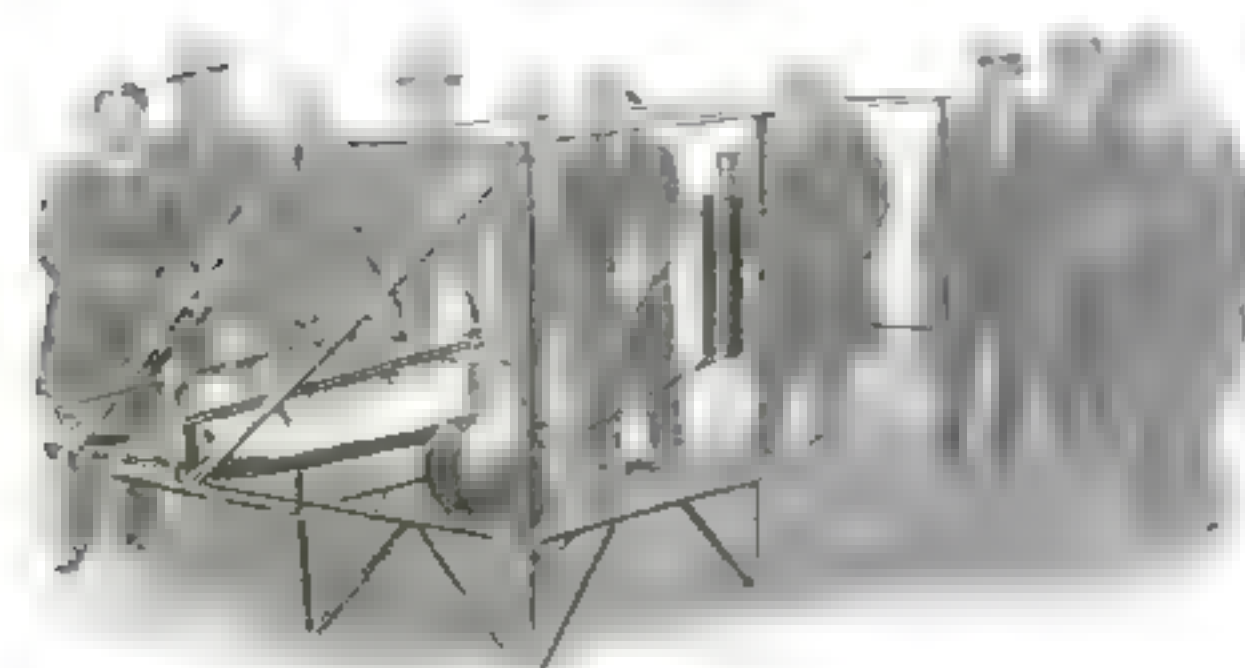
A SEVENTEEN-FOOT "Zeppelin" atop a steel mast tells which way the wind blows at Bolling Field, Washington, D. C. Illuminated at night and visible at great distance, it is being tested by Government meteorologists to see whether it may prove superior to ordinary weather vanes or "wind cones." The indicator, three feet in diameter, is hung so that it is free to revolve with the wind or to swivel up and down.

## CHICKENS GUIDE PILOTS

Cows and chickens warn aviators who fly regular cross-country routes when they are off their course, according to officials of a midwestern field. Pilots noticed that animals paid no attention to their planes on their regular runs, where aircraft were a familiar sight. But when the pilots missed their course, livestock on farms were visibly excited by the planes.

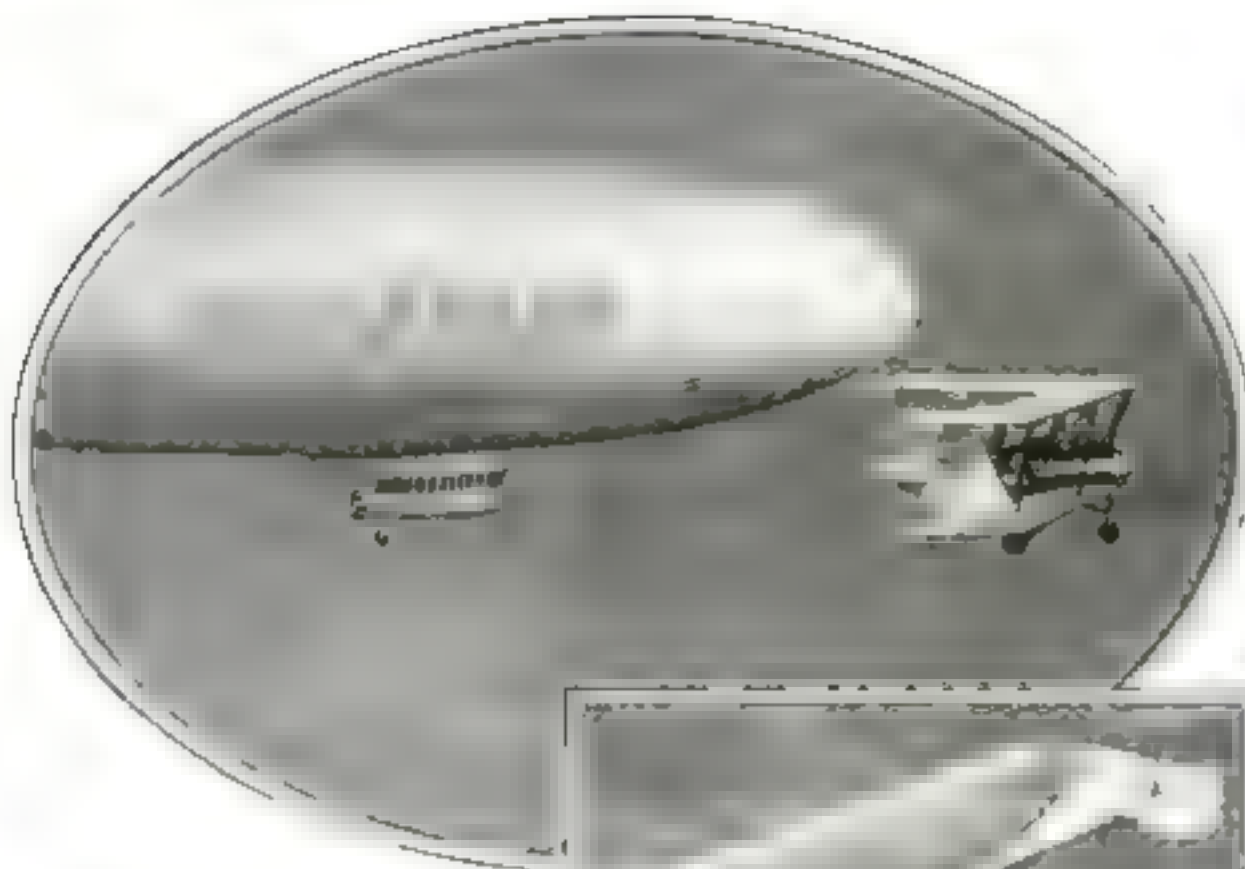
## TEST AUTOMATIC FIRE FIGHTER FOR PLANE

Fire hazard in the air is reduced by an automatic fire extinguisher for airplanes, recently demonstrated at Orly, France. Located in important parts of the plane are coils of tubing connected through pipes to the brains of the device, a sensitive thermostat. Fire gives its own alarm by heating the air in the tubes. Response is immediate. Sprays of fire-extinguishing liquid spurt against the flames from a number of nozzles strategically placed.



An automatic fire extinguisher for airplanes was tested in a stripped frame. A thermostat, actuated by heat, opens nozzles and sprays over the craft a liquid that kills the flames.





### V-SHAPED PLANE HAS LOW LANDING SPEED

AN UNUSUAL KING LINESS biplane recently was flown successfully at Miami, Fla. The unusual design was developed by the late Glenn Curtiss, pioneer aircraft manufacturer, just before his death. He planned a craft that could be hoped be manufactured at a price that would put it within reach of the average motor car owner and that would have many safety features as well. It is to be designed to loop, spin, dive the plane which has a landing speed as low as a sixteen miles hour.

The wings are brought to a point at the tips giving the plane a V-shaped appearance resembling the folded paper darts made by boys for throwing into the air. Power is supplied by a three-cylinder motor that turns a pusher propeller at the rear of the short fuselage. Two rudders are mounted at the sides, between the wings. A Miami manufacturer is said to have started making these planes.



V shaped plane, designed by the late Glenn H. Curtiss, was successfully tested in Florida.



This air-speed indicator designed for use on gliders shows take-off and landing speeds of craft.

Johnna Busse, of the Standard Glider Club of Washington, D. C. tries out the stall warning device, the attachments of which are behind her.

### DESIGN INSTRUMENTS FOR GLIDER PILOT

GLIDERS, the motorless craft of the air, may soon have a set of instruments as complete as those now found in airplanes. Pioneer experiments are being made by the Standard Glider Club of Washington, D. C., with instruments especially designed for gliders.

David Parker, Washington's youngest glider pilot, recently tried out a motorless craft fitted with an air-speed indicator like that used by airplanes, except that the dial is modified to give a larger reading because of a glider's slow speed. Now each club member gets a "flight ticket" after a soar, showing just what his air-speed performance has been.

Most unusual of the instruments tested, perhaps, is a "stall warning indicator." When the glider is moving at safe speed the wind forces a disk backward against a spring. Slowing of the glider allows the disk to advance, closing two silver contacts. Then a bell or buzzer behind the pilot's back warns him to "nose her down" before the craft stalls.



David Parker, of Washington, D. C., experiments with a speed gage, between his feet.

### NOISELESS PLANE NOW PLANNED

THE fact that under some circumstances loud noises can kill each other may be applied in a "ghost" airplane that would be silent. This idea was recently reported to the British Air Ministry by M. D. Hart, aeronautical engineer who has worked out the details of such a craft.

Physicists know that two organ pipes placed side by side, emitting notes of exactly the same pitch, may cancel each other's sound. Hart proposes to connect the "ghost" airplane's exhaust pipe with special pipes of suitable length to make the exhaust of each cylinder cancel the sound of the next. The propeller, another noisy part of an airplane would be made of four rather than blades spaced so that each blade would have its sound stifled by that of the next one.



## TWO-SEATER PLANE HAS ONE COCKPIT

A MINNESOTA teacher of aeronautics gave his students an unusual demonstration of putting theory into practice. In his spare time, John Akerman, head of the aeronautical engineering department at the University of Minnesota, designed a "chummy" two-seater plane in which pilot and passenger sit side by side as in an automobile.

Not content with his paper plans, he had the machine built at Minneapolis-Minn. It could be produced commercially, he says, at a cost within the limits of the average man's purse. The plane is twenty-two feet eight inches long with a wing spread of thirty feet. It is built low, being only four feet nine inches high.

The curious little monoplane has a single cockpit and is powered by a three-cylinder engine turning a "pusher" propeller. It has an uncovered fuselage, the spars of which act as a guard for the propeller, preventing it from accidentally striking anyone on the ground. A large spar extends from the bottom of the cockpit to the tail acting as a backbone or "keel," giving strength and rigidity to the little plane. Akerman is a native of Russia and did his first flying in that country.

## USE MOVING MAP TO TRAIN BOMBERS

A LARGE map painted on cloth and stretched over rollers enables fliers to practice aerial bombing indoors at the United States Army's flying school at Kelly Field, Texas. Rotating the rollers moves the map under students seated in booths a few feet above it.

They sight at designated points on it through bombing sights like those fitted in Army planes, and release bomb-catches when they think they have sighted the target. The instructor checks their accuracy from a central desk connected by wires to the students' booths, as shown in the picture at the right.

Towns, rivers, bridges, cross-roads, railways, and dams—targets at which Army bombers usually aim—are painted on the miniature bombing range in realistic manner. Combined with its motion this gives student fliers a good impression of what they would see from an airplane that was flying at an altitude of 5,000 feet.



Seated above moving map, Army flying students at Kelly Field, Texas, practice dropping bombs.

## DILUTED HYDROGEN MAY FLOAT NEW AIRSHIP

Navy airships today are filled with nothing but helium—safe airship gas that cannot burn. Hydrogen, a slightly lighter and highly inflammable gas such as was used in the ill-fated British airship *R-101*, is ruled out. But Navy officers are now considering the possibility of mixing helium and hydrogen to give their new super-airships, under construction at Akron, Ohio, greater lifting power.

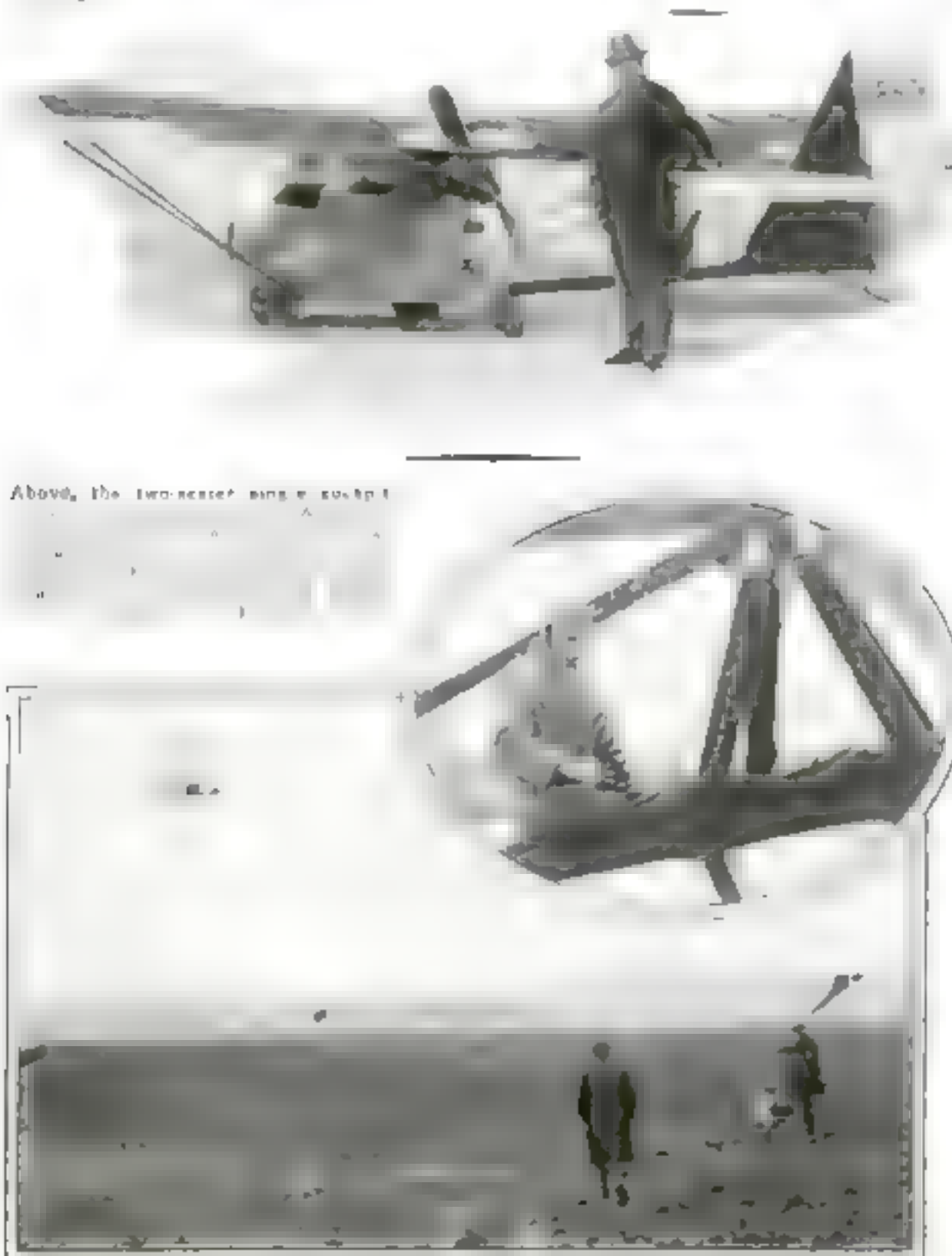
A mixture of ninety percent helium and ten percent hydrogen would not contain enough hydrogen to be inflammable, experts say. Such a mixture would enable the Navy's newest airship to lift about 4,600 pounds more weight than if filled with helium alone. This increased lift would enable the big dirigible to carry at least twenty-five additional persons, or

more guns or gas inc.

There would be some extra difficulty in the periodic task of repurifying the airship's gas, but this would be largely offset by the fact that hydrogen is much less expensive than helium.

## AUTOGIRO FLIES FROM ENGLAND TO FRANCE

A British aviator named Brie flew from England to France the other day in an autogiro, further demonstrating the reliability of such craft. After his arrival at Le Bourget Field, near Paris, the Britisher put his machine through its paces for the benefit of French aviation authorities, who had gathered for an air safety congress. The "flying windmills," described on page twenty-eight, are becoming more common on the world's airways. With their commercial production in this country, numbers of them may soon be seen at American aviation centers.



Above, the two-seater plane with cockpit.





# What It Means to Be Left-Handed

By JOHN E. LODGE

**A**RE you right-handed? Perhaps you only think so. There is one chance in seven that you are ambidextrous, or two-handed, without knowing it. If you are, you can learn to use your left hand as well as your right, and immeasurably increase your efficiency in work and sports.

Tests recently conducted by Dr. Thaddeus L. Bolton, head of the department of psychology in Temple University, Philadelphia, definitely confirmed earlier estimates that twenty percent of all people are ambidextrous. The experiments also brought out the striking fact that half of that number are unaware of it.

In other words, in every group of ten supposedly right-handed students Dr. Bolton subjected to the tests, there was one who, to his own surprise, proved to be ambidextrous. These cases the psychologist classes as instances of "suppressed left-handedness."

One of the tests is so simple that you easily can make it yourself. It is the wand-twirling test, designed to ascertain the learning capacity of the left hand. Both hands are given an equal amount of practice in twirling a light wooden wand, or stick, as a drum major twirls a baton.

If you believe yourself to be right-handed, begin by twirling the wand to the left in the fingers of the right hand. Do this for, say, three minutes and make careful note of the number of successful

twirls you accomplish. Then, for the same exercise, for the same length of time, with the left hand, twirling the stick to the right. Again note the number of successful

twirls. Repeat both exercises half a dozen times. The left hand will begin showing a lower average of successful twirls and remain lower throughout the test.

Now reverse the process. In the exercise with the right hand, twirl the wand to the right, and in that with the left hand, twirl it to the left. If you are decidedly right-handed, your right hand will surpass your left, as in the first test. But if yours is a case of suppressed left-handedness your left soon will outstrip the right, and keep its lead.

**TO CHECK** up on this experiment, Dr. Bolton, in his tests, inverted the order of the exercises. Taking a fresh subject, he had him do the second experiment first, and the first, second. In students with a tendency to left-handedness, the left hand showed supremacy from the start.

Three other tests preceded the wand-twirling experiment. First, Dr. Bolton measured the strength of the two hands of each of his subjects with an instrument known as a dynamometer. On this apparatus the stronger hand registers the higher mark. Then he determined speed and coordinated motion with a tapping test in which the rate of tapping for a certain length of time by both the right and left hands was recorded.

The third experiment was designed to ascertain steadiness of motion. To do this, the psychologist used a device consisting of a number of parallel brass bars set at different distances from one another. The students were told to pass a stylus, held first in the right and then in the left hand, from left to right and from right to left, through the intervals or openings between the bars, and to try not to let the stylus vibrate either up or down and thus touch either bar. When vibration occurs, an electrical contact is made and a bell rings; the number of rings establishing the ratio of unsteadiness.

Hundreds of Temple University students, both men and women, were subjected to these tests. Sixty-six percent were shown to be decidedly right-handed. Fifteen percent were decidedly left-



Dr. Thaddeus L. Bolton, Temple University, Philadelphia, is working in his psychological laboratory, making tests to determine the ambidextrous ability of his students.

handed. The remaining twenty percent were ambidextrous, but only half of them knew it.

This ambidexterity varied in degree, for "two-handedness" does not always mean exact equality of both hands. If you perform most of your tasks with the right hand and yet possess a left hand of considerable skill, you are ambidextrous.

"The real value of this work," Dr. Bolton told me the other day, "lies in its possibilities when applied to children. All public school pupils after they have reached the sixth grade and begun to show occupational and professional preferences should be tested.

"The tests would prevent attempts to train young persons in specialized two-handed work if they are not suited to such tasks. Certain types of employment, such as type-writing, operating typesetting machines, and piano playing require a high degree of ambidexterity.

"My plan would be to test all children and only train those to be ambidextrous who use both hands with equal facility in the tests. To train those who are strongly and definitely right- or left-handed is inexpedient. Let them find occupations in which one-handedness is no handicap.

Dr. Bolton's theories differ sharply from those of Dr. P. Armand-Gaud, of the French Academy of Medicine, who, in a recent lecture before that body, suggested that children be trained to write with both hands. The habit of using only one hand, he declared, is ridiculous, needless, and obsolete, and any adult, with several months' practice, can make his left hand as useful as his right.

**D**R. BOLTON says it would be difficult to do this, as the relationship between the two hemispheres, or halves, of the brain and the two hands is hard to change. A right-handed person is left-brained, meaning that the left half of the brain leads in all action. A left-handed person is right-brained. This accounts for the circumstance that a right-handed person also is right-eyed, right-legged and right-footed, in fact, his entire right side is developed a little more strongly and is a little larger than his left side. In a left-handed person, the opposite is true.

When a right-handed person uses his left hand, he probably uses his left brain working through the right brain, instead of the right brain directly. But if he is to be made permanently left-handed, he also must be made right-brained.

In this connection, the psychologist told me that there is no direct relationship between "handedness" and intelligence. In other words, left-handedness in a child is no more a sign of backwardness than right-handedness is a symptom of

brightness. The belief that there is such a connection is due to the fact that some backward and feeble-minded children happen to be left-handed.

**T**HIS belief is chiefly responsible for the widespread prejudice against left-handedness, which has survived even among educated people. Dr. Bolton told me he receives a surprisingly large number of letters from teachers in various parts of the country, complaining that they lack the authority to "break pupils of left-handedness."

"They write me that the parents don't

can do something—for example, writing with the left hand—that the others can't. They have a specialty. This tends to make them independent and self-reliant.

For these reasons I deem it inadvisable to 'break' a child of left-handedness. But developing the other hand and thus encouraging ambidexterity is an entirely different matter. Here the transfer is not as severe and consequently not as difficult."

Persons who generally use the right hand but prefer to perform certain tasks such as, for instance, handling the cue iniards, with the left, are cases of suppressed left-handedness, according to Dr. Bolton. Such people, he says, can train themselves to be ambidextrous without undue effort.

What produces left-handedness? The primary cause of left-handedness is the tendency of our brains and bodies to depart from a strict symmetry, or balance. This lack of symmetry manifests itself in a larger brain hemisphere on the left accompanied by a slightly larger body development on the right side, or in a larger brain hemisphere on the right with a slightly larger body on the left.

**T**HAT these differences exist has been established by careful measurements of left-handed and right-handed persons. But the matter still is very much in the guessing stage. Some weeks ago, two investigators of the University of Chicago, Loh Beng Tsai and Siegfried Maurer, succeeded in mak-



The purpose of this typewriter and three hole test is to determine dexterity with both hands.

seem to care much," said Dr. Bolton, "and I tell them the parents are right. There is little occasion for changing left-handed people to right-handed people. Left-handed writing is just as fast as right-handed, and in almost all instances it is just as easy to read.

"As a matter of fact, left-handedness even has some advantages, particularly in sports. As everyone knows, a good 'southpaw' pitcher in baseball is invaluable because he confuses the opposing batter. Many of our greatest diamond stars were and are left-handed. Babe Ruth is the greatest left-handed slugger of all time and once was a brilliant southpaw pitcher. 'Lefty' Grove of the Philadelphia Athletics and Pipgras of the New York Yankees are other examples. In football, too, some advantage is gained by a team that has a man playing a left-handed tackle or a left-handed guard to the confusion of the opposing eleven.

"Most left-handed children feel superior to their playmates. The reason is that they



Endurance and coordinated motion were tested by tapping, number of taps a minute being electrically recorded.

ing a number of right-handed white rats left-handed by feeding them a diet lacking in vitamin B.

In these experiments, the rats, after having been deprived of vitamin B for a certain period, were fed from long-necked bottles. Rats, it appears, eat with one paw. Those formerly right-handed stuck their left paws into the bottle necks.

One hundred male and one hundred female rats were used in the tests. Of the males, sixty-nine were right-handed and thirty-one left-handed before vitamin B was denied them. Afterward, exactly half were left-handed. Of the females, fifty-four were right-handed and forty-six left-handed, and the left-handed group was increased by three as a result of the test.





Cruising through the traffic of New York City, Schalkham studies license numbers and watches for lost autos.

**T**O ONE man in New York City, the ceaseless stream of traffic that roars through avenues and streets is a perpetual procession of numbers. Flitting in and out of the bewildering maze in his police automobile, Patrolman August Schalkham does not see the trucks, roadsters, touring cars, and limousines that surround him. He cares little about the shape and make of the machines, nor about their drivers and occupants. For him the unending pageant resolves itself into a passing show of license plates, the numbers on which he constantly compares with those on a list of more than 1,000 stolen cars. And that long list Schalkham carries—in his head.

Entirely on his own initiative this terror of automobile thieves has developed his memory to the amazing point where, thus far, it has enabled him to pick 183 stolen cars out of the welter of vehicles that chokes the streets of New York. In his capacity of "number hunter" he has become so valuable to the force that he has been taken off fixed post and given a police car and a roving assignment to cruise where he will in pursuit of stolen machines or "hot" cars, as the members of the city's underworld call them.

The other day, I sought Schalkham "Eagle-Eyed Gus" to his brother policemen, to find out how he made himself into a one-man bureau for the recovery of stolen automobiles. I met a big, burly, good-natured cop, just as modest about his remarkable feats of memory as he is about the ribbons of three citations for bravery that adorn his police tunic just above his badge.

"IT'S my hobby," he told me. "Some people collect postage stamps, or oil paintings, or diamond necklaces. Others 'collect' cars that don't belong to them. I get a lot of fun out of memorizing numbers."

"It started when I was a kid. My brother and I used to play a 'number game' with passing freight cars in the



## Cop's Memory Recovers Stolen Autos

By CLAYTON R. SLAWTER

terminal yards near where we lived. We would look hard at the numbers one day and then try to spot the same cars when they passed again days after ward.

"I hadn't thought much about this old stunt until two years ago, when I was put on traffic duty on Manhattan Bridge. It was a slow job, so, to keep my mind occupied, I kept a notebook. I wrote down the numbers of stolen cars broadcast by headquarters in regular numerical order, and then compared them with the licenses of the cars driving across the bridge. I started with about twenty-five numbers. Because I looked so often in the book, the numbers just naturally

stuck in my mind. Pretty soon I didn't need the book at all, and I began to play the old 'number game' all by myself. After a while, I could remember hundreds of them. It's all a matter of practice I guess."

In addition to his ability to memorize numbers, Schalkham has developed the faculty of reading licenses on every car in the thickest traffic. The faster they come, the better he likes it.

"WHEN you come right down to it," he explained, "it's the same system they use in the grade schools. The children learn their A B C's from looking at blocks, and cards, and pictures. Well, it's the same thing with license numbers. If you look hard enough at a thing, it will stick in your mind."

In this way, Gus has developed his memory until it now is as sensitive and retentive as a photographic plate. Naturally, his ability to remember faces and names has kept step with his uncanny faculty for remembering numbers. But he does not rely entirely on his unusual mental prowess when making arrests. He always carries with him a small card index, and the number on a wanted car is checked from this before he goes after its driver. The index is simple. Serial numbers and letters of licenses are arranged in numerical and

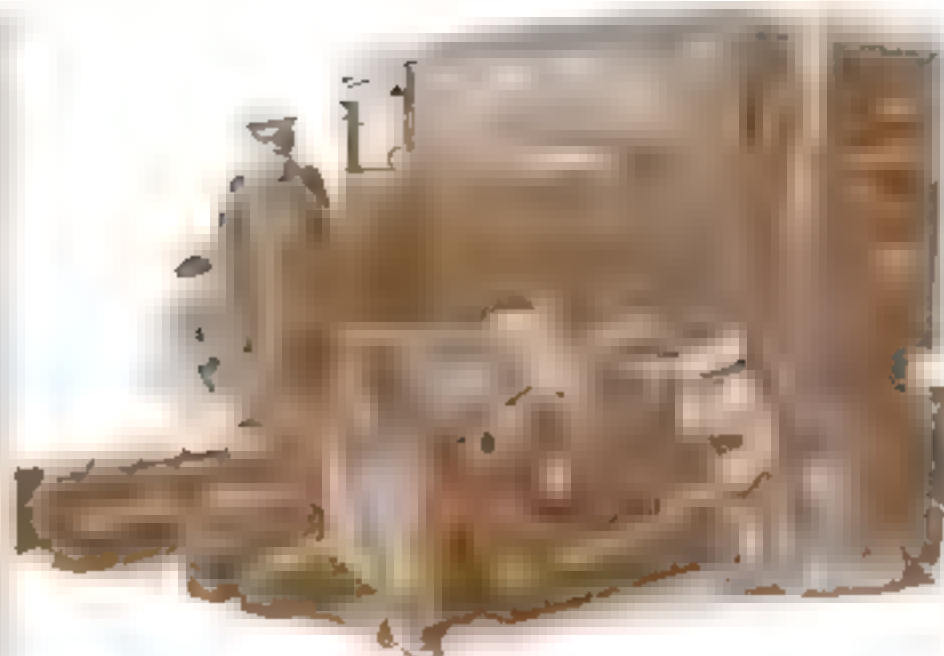


Eagle-Eyed Gus, before making an arrest always confirms his memory with pocket list.

alphabetical order in the left-hand column of a card, for example, 1-A, 2-A, and 1-B, 2-B. Remaining figures of licenses of stolen cars in that series are listed to the right, also in numerical order.

As for the ribbons on his uniform, one was received from the U. S. Army while fighting in France during the World War. The other two were for police work.

# How U.S. Army Trains Its Signal Experts



Electric batteries, extensively used by the Signal Corps, are likely to go dead and this portable charging unit then is called.



All branches of military communication are taught to enlisted men at the Army Signal School, Fort Monmouth, N. J. The man above, in the meteorological unit, is fixing a wind gauge.



Radio and telegraph are united for distant communication, and messages are sent and received from a field station like this.

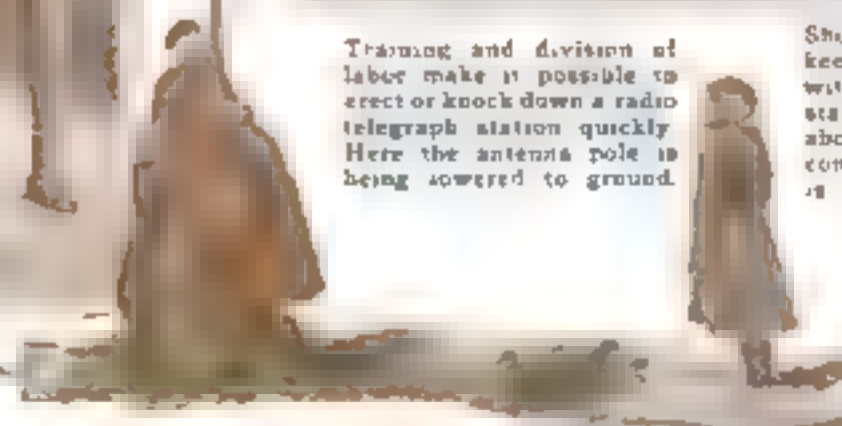


The camera plays an important part in the work of the Corps and thorough instruction in using the motion picture machine is given members of the photographic class, three of which are shown above.



Training and division of labor make it possible to erect or knock down a radio telegraph station quickly. Here the antenna pole is being lowered to ground.

Short wave loop radio sets keep the front line in touch with headquarters. A field station, like the one seen above, is set up and used for communication with the rear as possible at all times.



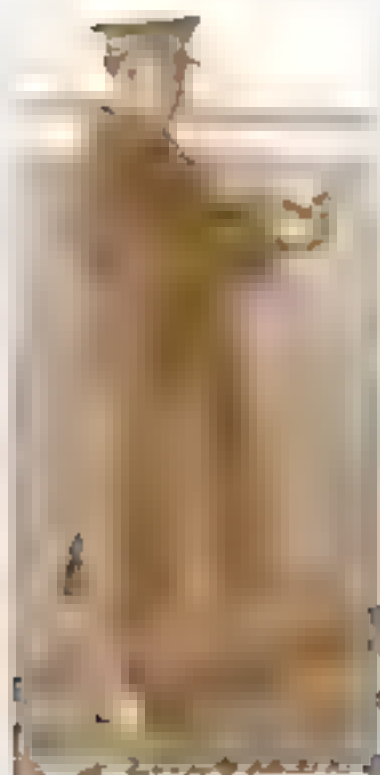




The big old plane  
is flying in the  
sky. The message is  
sent by the plane  
and the message is  
sent by the plane.



The people are sitting  
on the ground. They are  
sitting on the ground.  
The people are sitting  
on the ground.



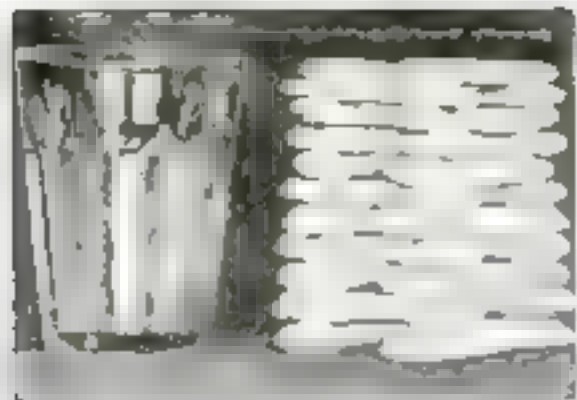
The person is standing  
in the field. The person  
is standing in the field.



The person is standing  
on the tall structure. They  
are standing on the tall  
structure.



The person is standing  
next to the large wheel. They  
are standing next to the  
large wheel.

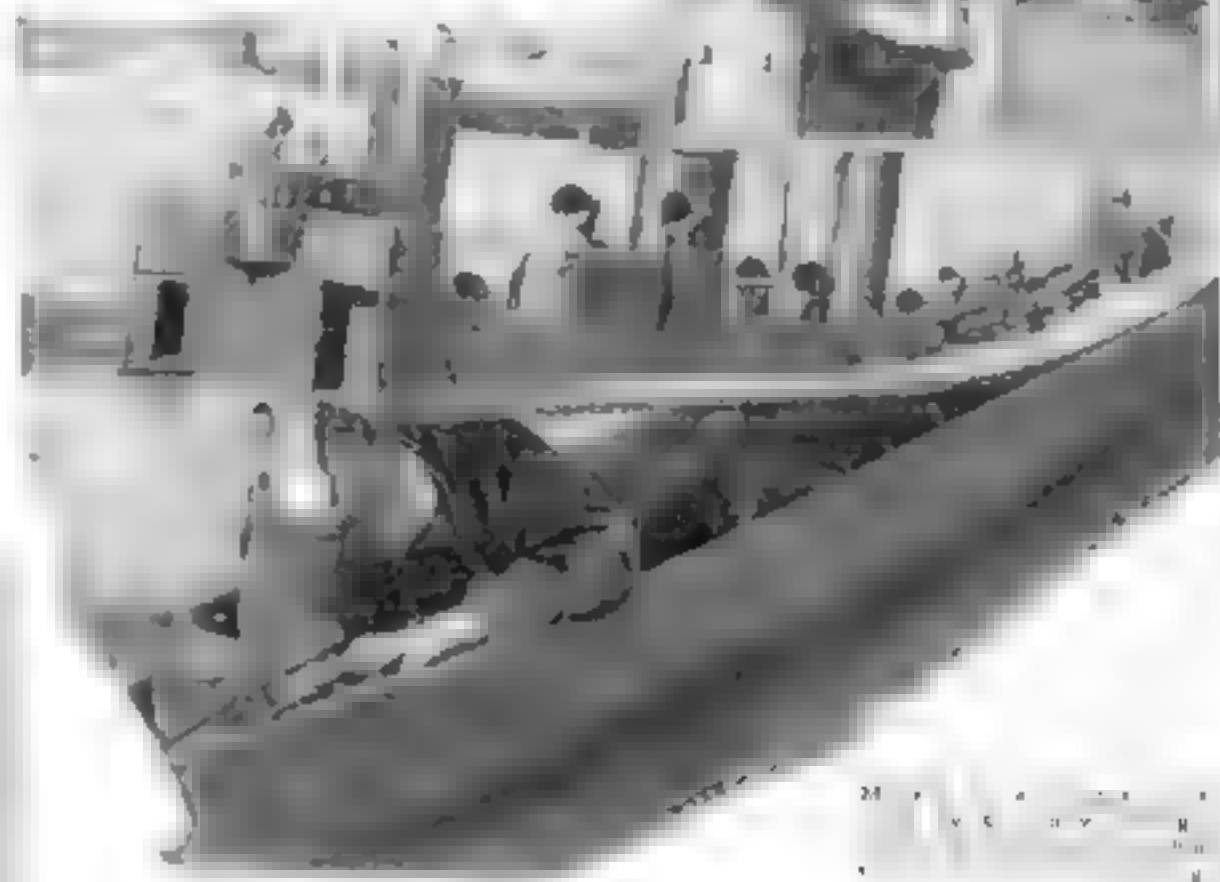


### INDIUM WORTH \$17,000; WHAT'S IT GOOD FOR?

HAVE you ever heard of "indium"? Here is what \$17,000 worth of it looks like, posed beside an ordinary drinking glass for comparison. A pound of gold would buy scarcely enough of it to make a tin can. Indium is a soft, silvery metal that takes a good size for its weight.

A few months ago, a Cleveland, O. chemical firm announced proudly that it had prepared more than a pound of pure indium. Its rarity alone is responsible for its costliness, since no one has yet discovered a vital use for it. Recently, however, experiments have shown it can be used in alloys of which high-temperature thermometers are made. Its compounds may prove to be drugs having valuable new medicinal properties. One of these days, some experimenter may make a name for himself by discovering a use for indium.

### GERMAN PUPILS TAUGHT WITH SHIP MODELS



Left, above, signal balloon rising from box. Above, the balloon over a wrecked plane.

### TINY BALLOON SERVES AS PLANE'S SOS

AIRPLANES in distress could fly their own SOS signals, through a device recently developed by T. H. Furman, of Rialto, Calif. His invention is a small box with a spring lid, containing a small captive balloon, carried near the tail of the fuselage. If forced to land, a pilot would release the brilliantly-colored gas balloon, which, rising to the end of its tether of light wire, would guide rescue pilots.

### SKYSCRAPERS DIE AT 30

THOUGH modern skyscrapers look as if they would last for ages, their actual life seldom exceeds thirty years. The National Association of Building Owners and Managers says that tall buildings do not wear out, but are torn down to make way for more modern structures.

### NEW STEP IN CONQUEST OF PERNICIOUS ANEMIA

News of another advance in the battle against the dread scourge of pernicious anemia follows the recent presentation of POPULAR SCIENCE MONTHLY'S \$10,000 annual award in science to Drs. George H. Whipple and George R. Minot, pioneers in the malady's conquest.

These two men discovered that a diet of liver would cure sufferers from the disease, for which no cure had been known. The liver diet proved a quick and powerful factor in the production of red blood cells. So that patients need not eat the half pound of liver daily that this diet would require, the discoverers also succeeded in separating a "liver fraction" containing the chemical that is of benefit. As a result physicians have prescribed it during the last year, in powder form.

Now a new step in concentrating the chemical has been accomplished by three investigators at the Columbia University College of Physicians and Surgeons and Presbyterian Hospital—Drs. R. West and H. D. Dakin, and Marion Howe. They have isolated from liver the undiluted antianemia chemical. If it can be made synthetically, it raises the hope that a cheap anemia remedy may be had.

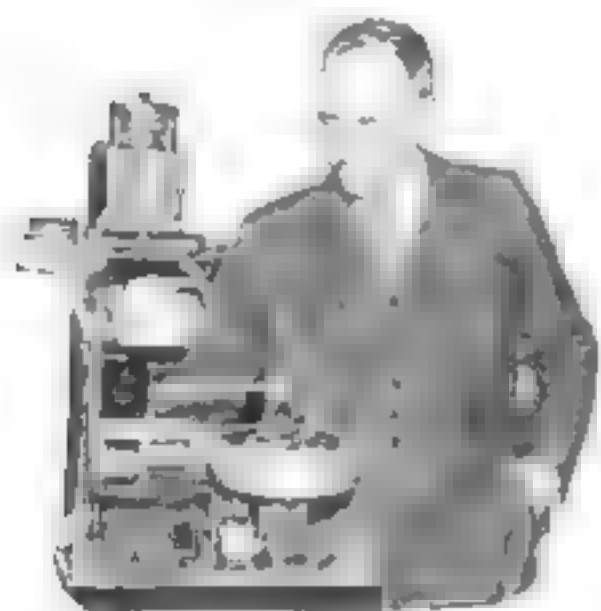




### NEW TOOL COMBINES MITER AND RULE

A COMBINED miter and folding rule, handy for carpenters and cabinetmakers, has been developed by a New York firm of tool manufacturers. The device can be set to register angles as well as measure distances in feet and inches.

Lock joints between its sections can be set rigidly at forty-five or ninety degrees when marking bevels or angular cuts. Use of this instrument eliminates the necessity for miter boxes on many small jobs.



### MACHINES TO PREPARE, COOK, AND SERVE FOOD

AUTOMATIC machines will place food before a diner and whisk his empty dishes away to be washed, in a New York restaurant planned by H. Russell Brand, New York City inventor. No human hand will touch the dishes.

Recently in his laboratory, Brand exhibited one of his inventions for the restaurant, illustrated above—an automatic wheat cake cooker and server. When a demonstrator inserted a slug supplied by a "cashier," the grill started working, and placed the finished wheat cakes on a plate which a moving belt deposited, through a door, before a person representing a diner. When the "diner" arose, the tray was carried off to be washed automatically.

### AIR IGNITES THIS PASTE

A GERMAN firm announces the perfection of a "fire paste," in semisolid form put up in a container resembling a tooth-paste tube. When the tube is squeezed, the paste liquefies and as a drop of the clear liquid falls it takes fire in the air. Caught in a suitable receptacle it can be used to light cigarettes or start a fire.

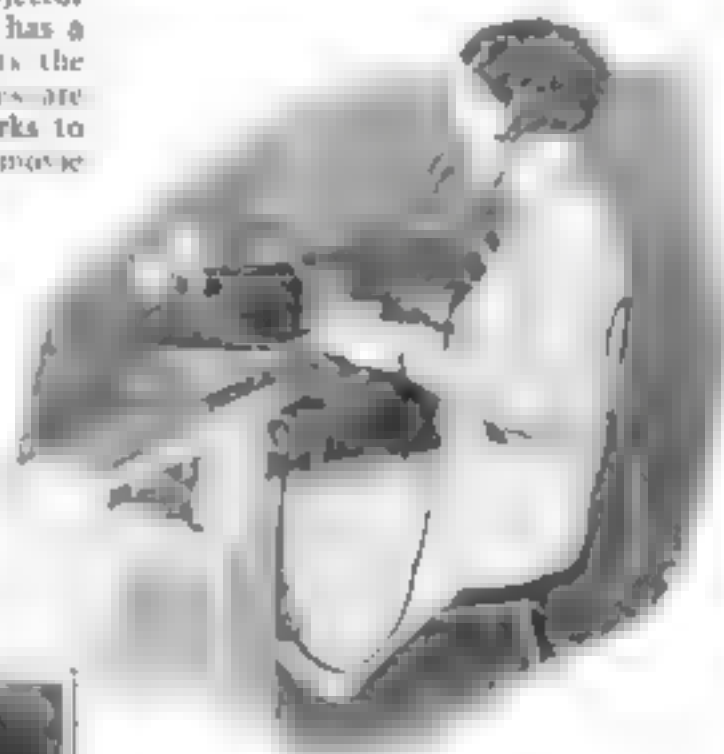
## MOVIE PROJECTOR HAS MIKE SO OPERATOR CAN TALK



Attached to this portable movie projector is a microphone that enables the operator to cut in and explain the scenes pictures or cut out sound and give his own explanation.

A PORTABLE motion picture projector recently perfected in Chicago, Ill., has a microphone attachment that permits the operator to talk when silent movies are being shown, or add his own remarks to those of the talking pictures. Home movie film is used in the projector. A phonograph supplies sound for the talks. When the operator plugs in, both the sound record and projector run out of.

The apparatus is packed for transportation in two cases. One contains the phonograph with amplifier and accessories. The second carries the loudspeaker projector, three reels of film, and connecting cords for assembling the device.



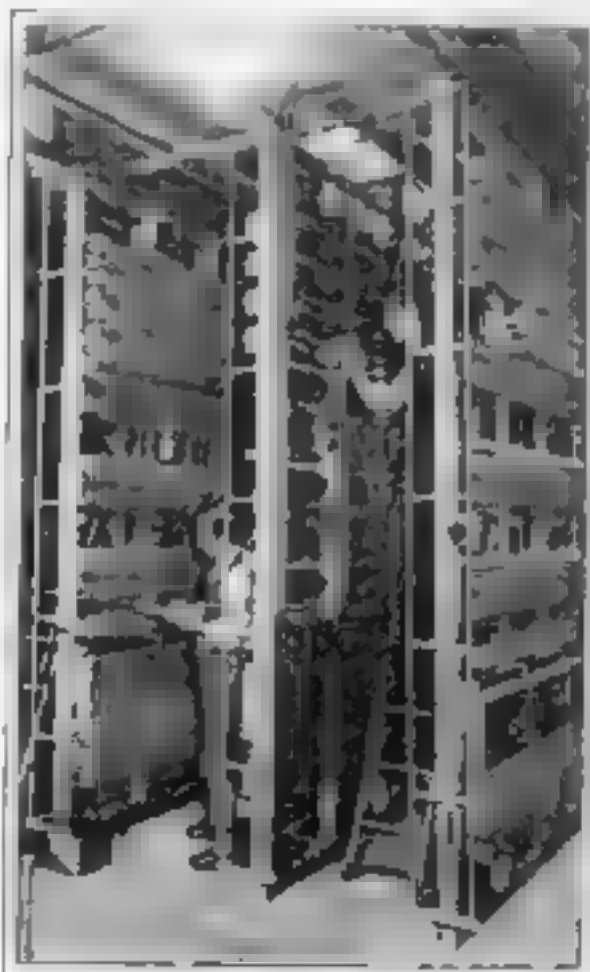
### SUPER-ROBOT SPEEDS PHONED TELEGRAMS

WHEN a New Yorker calls one of the city's principal telegraph companies on the phone to send a wire, he now sets in motion a super-robot so swift that a stop-watch often cannot time it.

Within the short space of one second, on the average, he hears the answering voice of one of 110 girls, who sit at desks as shown in photo above. This is made possible by the "automatic call distributor," called one of the most important inventions in recent years.

This intricate machine, a maze of contacts and wires twice as tall as a man, instantly detects an incoming call, hunts for and finds an unoccupied typist, plugs in a connection to her desk, and signals that there is a message for her to take. If she fails to respond, the robot switches the call to another typist.

Similar "robots" are planned for Chicago and Boston, according to Western Union officials who installed the first one.



This super-robot, only one of its kind, distributes incoming messages in record time.

## DICE STRUNG TOGETHER NEW GOLF TEE



A WESTERN caddy invented this new golf tee, in the form of cast rubber dice. The two dice are held to each other by a stout cord twelve inches long. Rounded grooves on the six sides of each die make it possible to use either one as a tee for the golf ball. For a higher tee one is set on top the other. The cord and extra die, when one is used for a tee of average height, serve as an anchor if the club is swung too low and hits the tee. In this manner the tee is prevented from being knocked far, and it is easily seen against the turf.

S. W. Roth, the inventor of the tee, is seen at the left.

Two dice fastened together are designed to be used as golf tees.



## MOVING LAMP SHADE SERVES AS CLOCK

A clock and an electric lamp are combined in a novelty recently placed on the market in New York City. A tiny electric motor mounted in the center column rotates the lamp shade, the lower edge of which is divided into hours and minutes past a fixed pointer. An automatic clutch permits the shade to be removed, stopping the motor. It also allows the shade to be revolved by hand when setting the clock.

Since the driving motor runs independently of the lighting, the clock runs whether the lamp is turned on or not. The motor is noiseless in operation and the shade moves so slowly that its motion is hardly visible. The shade makes one revolution in twelve hours, giving the effect of clock dial moving past the hour hand.



In this specially constructed cabin airplane horses are carried swiftly from track to track and after a long journey through the sky they are unloaded in perfect condition.

## WHISTLE FINDS SHIP'S DISTANCE FROM SHORE

BLOWING a special whistle recently installed on the *Prince Robert*, her captain can find out how far he is from cliffs in thick weather by noting the time required for the echo to return. If ten seconds elapse before the echo is heard, he knows that he is about one mile offshore. The sharp, dry-toned whistle helps to navigate difficult passages between islands and mainland off British Columbia. At its left, in the photograph, is a common whistle, and at right the usual siren.

## CITY FOLKS OUTNUMBER COUNTRY PEOPLE

CITY dwellers in the United States, according to a recent announcement of the Census Bureau, outnumber country people. Fifty-six out of every one hundred people in America make their homes in urban districts. This represents an increase over the figures for 1920, when the city dwellers were in the majority by the narrow margin of fifty-one of every one hundred of population. Places with a population of more than 2,500 were included in the "city" class.

## FLYING STABLE CARRIES RACE HORSE TO TRACK

THE latest development in luxurious transportation for thoroughbred race horses is a flying stable recently built by a California airplane manufacturer.

All fittings were removed from the cabin of an enclosed monoplane and large windows were cut into its side walls. Strong bars were placed across them so the animal could not hurt himself by breaking through them if he took fright while in the plane.

A Western trainer used this unusual machine recently to transport a horse to a Mexican race track. He said the animal arrived in good condition and he suggests that in the future planes will be generally used to transport horses.





## HIGH VOLTAGE CURRENT EXTINGUISHES FLAME

FIRE in a mine is always a deadly peril. Explosions and cave-ins may block the work of the fighting brigades equipped with ordinary apparatus. Therefore mine officials watched with unusual interest the experiments of Bernard Lewis, physical chemist at the Pittsburgh, Pa., station of the U. S. Bureau of Mines, who recently demonstrated that he could put out a flame with electricity.

Lewis lit a gas flame in a glass tube. Then he brought near it from each side a piece of wire gauze charged with high voltage electricity. The flame vibrated convulsively, dwindled and went out, leaving carbon monoxide gas and gaseous carbon and hydrogen compounds like the dreaded fire damp of miners were successfully extinguished.

The electrically-charged pieces of gauze, Lewis told *POPULAR SCIENCE MONTHLY*, literally tear the flame to pieces. When an inflammable gas burns, the hot flame throws off particles of negative electricity, leaving the products of combustion charged with positive electricity. His high voltage electric field draws negatively charged electrons to one electrode and positively charged particles to the other, breaking up the flame. Whether the same thing may be done outside the laboratory, and if so on how large a scale, remains to be seen.

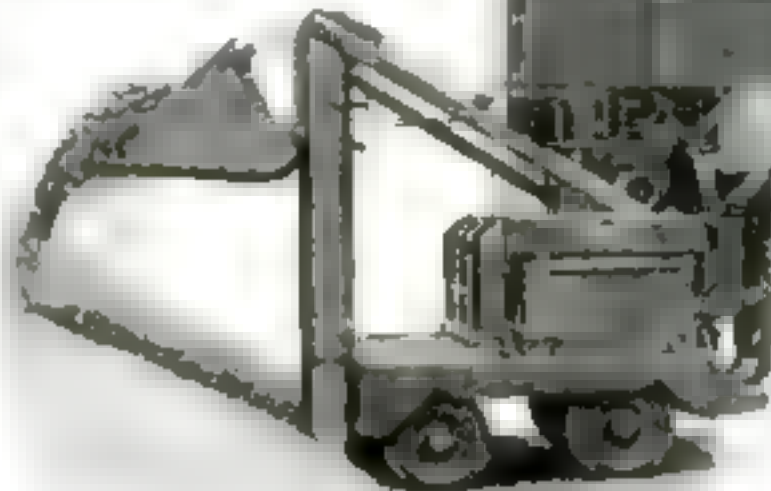
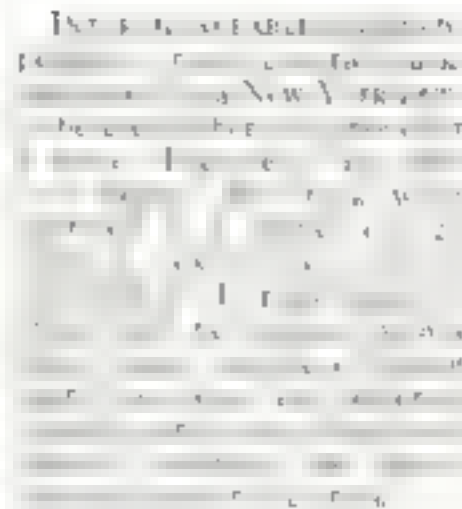
## FIRST CAR TO TRAVEL CANADIAN WILDERNESS

First to cross Canada by motor from coast to coast is the ambition of Healy Needham, of Toronto. Recently, he fitted his eight-cylinder roadster with an iron bar, in place of a bumper, and started out from Halifax, in Nova Scotia, with a northern bushman for company. His announced destination was Vancouver.

Needham's attempt recalls pioneer motoring days in the United States, where today's transcontinental highways have made such a trip easy.

The trail blazers keep in touch with civilization by radio. At first they made about a mile a day in the Ontario wilderness, cutting young tamaracks and laying half a mile of board road at a time. With frozen ground, the traveling is easier.

## NEW TRUCK WORKS AS SHOVEL OR CRANE



At a recent show it was demonstrated how the new truck works as a crane.

At a recent show it was demonstrated how the new truck works as a shovel.

## HANDMADE BIBLE WEIGHS 1,094 POUNDS



Louis Waynat of Los Angeles, Calif., exhibits the Bible weighing 1,094 pounds which he made by hand.

A BIBLE too heavy to carry about is the work of Louis Waynat of Los Angeles, Calif. It weighs 1,094 pounds, has 8,048 pages, and is bound in thirty-two detachable sections so it can easily be taken apart for transportation. Taking it apart or putting it together requires about half an hour's work. When opened, the volume is eight feet two inches in width, and when closed it is thirty-four inches thick. Waynat made the type himself and printed the book by hand, taking two years to complete the large Bible.



Brazing an auto trail through the wilderness of northern Ontario, Healy Needham, of Toronto, is determined to be the first man to cross Canada from coast to coast in a car.



### USE WATER AND PAINT TO QUELL BERLIN RIOTS

Now have an armored car equipped with a high-pressure water spray and a paint spray.

The car has a nozzle that discharges water at about 150 pounds pressure. Other nozzles at the sides of the machine spray water at about the same pressure. Police have found this pressure sufficient to knock people off their feet without injury.

Steel shutters completely inclose the truck's operators and prevent them from being injured by stones or bullets. A screen like a steel Venetian blind covers the windshield, protecting the driver.

Another method of scattering mobs recently devised by the Berlin police is a paint spray. A conical-shaped device resembling a fire extinguisher is filled with paint and squirted at random over a crowd of rioters. This breaks up the riot and also marks those in the mob.

A high-pressure water spray gun and in circle Berlin's armored car that sprays water.



A ten-foot Komodo lizard modeled of cellulose acetate.

### MODEL BIGGEST LIZARD IN CELLULOSE ACETATE

Making museum models is the newest use for cellulose acetate, a substance used in "dopes" for airplane wings during the World War, and recently made available for commercial uses by a Wilmington, Del., firm. Recently experts of the Field Museum of Natural History used it to create an amazingly lifelike image of one of the giant lizards of Komodo, Dutch East Indies.

The huge lizards of Komodo were discovered in comparatively recent years on this tropic island, which the Dutch government has now made a game refuge to protect them. They are by far the largest living lizards in the world, and attain a maximum size of ten feet. Probably they are direct descendants of even greater reptiles, the dinosaurs of prehistoric times.

The specimen used in making the Field Museum exhibit was collected by the recent Chancellor-Stuart expedition to the South Islands. The Komodo lizard of which exaggerated reports have come from the natives was first seen by a white man in 1910. A voracious eating scavenger, efforts are now being made to keep it exterminated. It is closely allied to the monitor lizard of Australia and Africa.

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### RADIO GUIDES ENGINEER IN FOG

Heavy fog, blinding darkness, may be beaten by radio.

In Germany, Dr. H. G. G. has developed a radio guide for fog. The engineer's car gives him orders, him to proceed safely whether the signals ahead or not. A square loop aerial on the car receives the radio impulses and transmits them to the loudspeaker in the car.

The new system is recently installed for testing in four switching yards, one of which is shown in the photograph. The car receives the radio impulses and transmits them to the loudspeaker in the car.

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The new system is recently installed for testing in four switching yards, one of which is shown in the photograph.



## THUMB REST INSURES RIGHT GOLF GRIP

A THUMB rest for golf clubs shows beginners at the game how to hold their clubs correctly during play. The little button-shaped device is secured to the club handle by a small screw and spring clip, making it adjustable to suit the individual user. By insuring correct position of the hands in gripping the club, it eliminates many missed shots and keeps the striking face of the club head in proper relation to the ball.



A rest for the thumb clips to a golf club and makes certain the beginner's grip is correct.

## FILTER KEEPS PHONE NOISE FROM RADIO

Your dial phone is a miniature broadcasting station, and the sparks it makes when a number is dialed may cause noises in near-by loudspeakers. Such interference is prevented by a small condenser that keeps telephone noises from radiating. It is easily installed in the base of the phone by changing a wire connection and removing a few screws. Its operation is entirely automatic and does not interfere with use of the phone in any way.



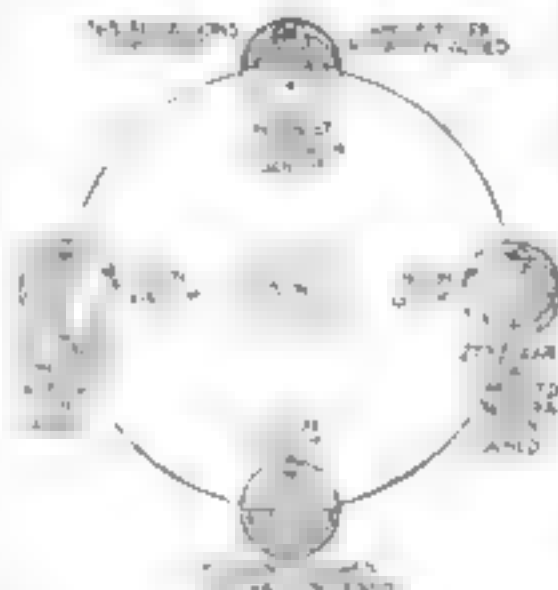
A condenser easily installed in base of your dial phone stops its interference with radio.



Harold Herbert, who with Dr. J. A. McReay, New York City, invented portable record maker, is seen above making a record and at right carrying the outfit.



## EARTH ROTATES 366 TIMES IN 365 DAYS!



For convenience, let us begin the year as the astronomers do, at noon on January 1, when the sun is on the meridian at Greenwich, England. Our year will then consist of about 365 "solar" days, each of which is the interval between noon and noon at Greenwich. How then can an extra rotation of the earth on its axis slip in without being noticed?

During the three-month interval between noon on January 1 and noon on April 1, the earth has turned on its axis ninety rotations in all. Yet our diagram shows that at the completion of the nineteenth rotation at noon on April 1, Greenwich itself has gained a quarter of a rotation! At Greenwich noon on July 1, the meridian of Greenwich is facing the opposite quarter of the heavens from that which it faced on January 1. The earth has now gained half a turn!

On October 1, the earth has added three fourths of another rotation. And at noon in Greenwich on the next January 1 (365 solar days from the year's start) the earth has made 366 complete rotations, but without adding a day to the year!

## PHONOGRAPH RECORD MAKER IS PORTABLE

PACKED in a box that may be carried by hand like a suitcase, a new phonographic record maker and reproducing device can be taken anywhere for making records of a person's voice. The apparatus, perfected in New York City by Dr. J. A. McReay and Harold Herbert, consists of a phonograph turntable, amplifier, and electric pick-up device mounted in one case. Records made on it are square and said to be scratch-proof.

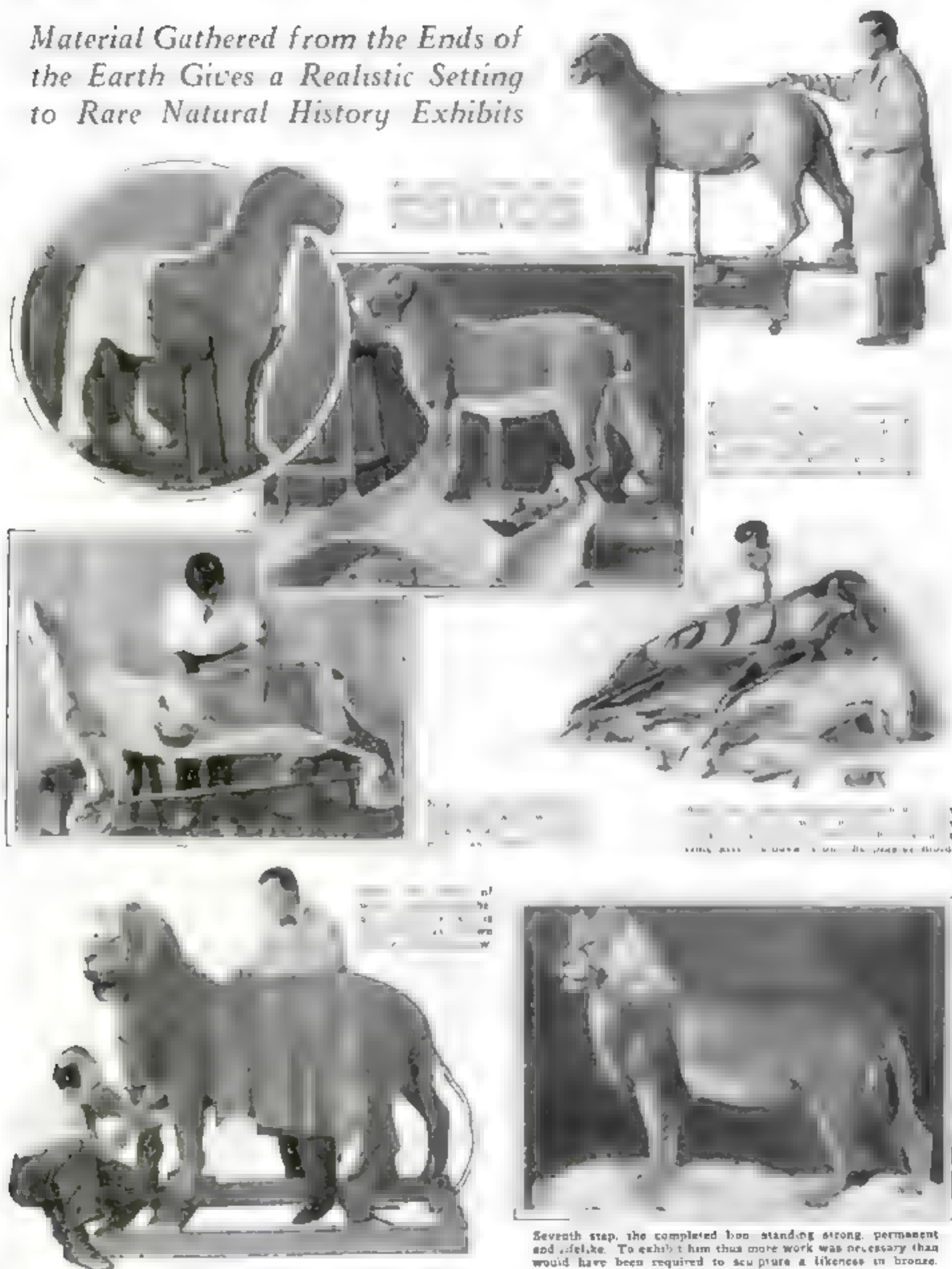
It has proven an advantage to clergymen and public speakers in preparing sermons and talks because it permits them to listen to their own speeches before making them in public.

## WOULD GUARD AGAINST OPTICAL DELUSIONS

CONJURERS and stage magicians at every university to teach students how easy it is to fool the human senses are advocated by Prof. A. V. Hill, British biologist. By study and practice magicians can make audiences see things that are not visible and fail to see things that are. Similar pitfalls exist in scientific experiments, as well as in many affairs of ordinary life, the professor points out. Yet many business and scientific men continue to be fooled by the evidence of their senses. Every student of arithmetic is taught to prove his calculations, and similar ways of proving things observed by the senses is needed, says Prof. Hill.

# Here Is Why Museum

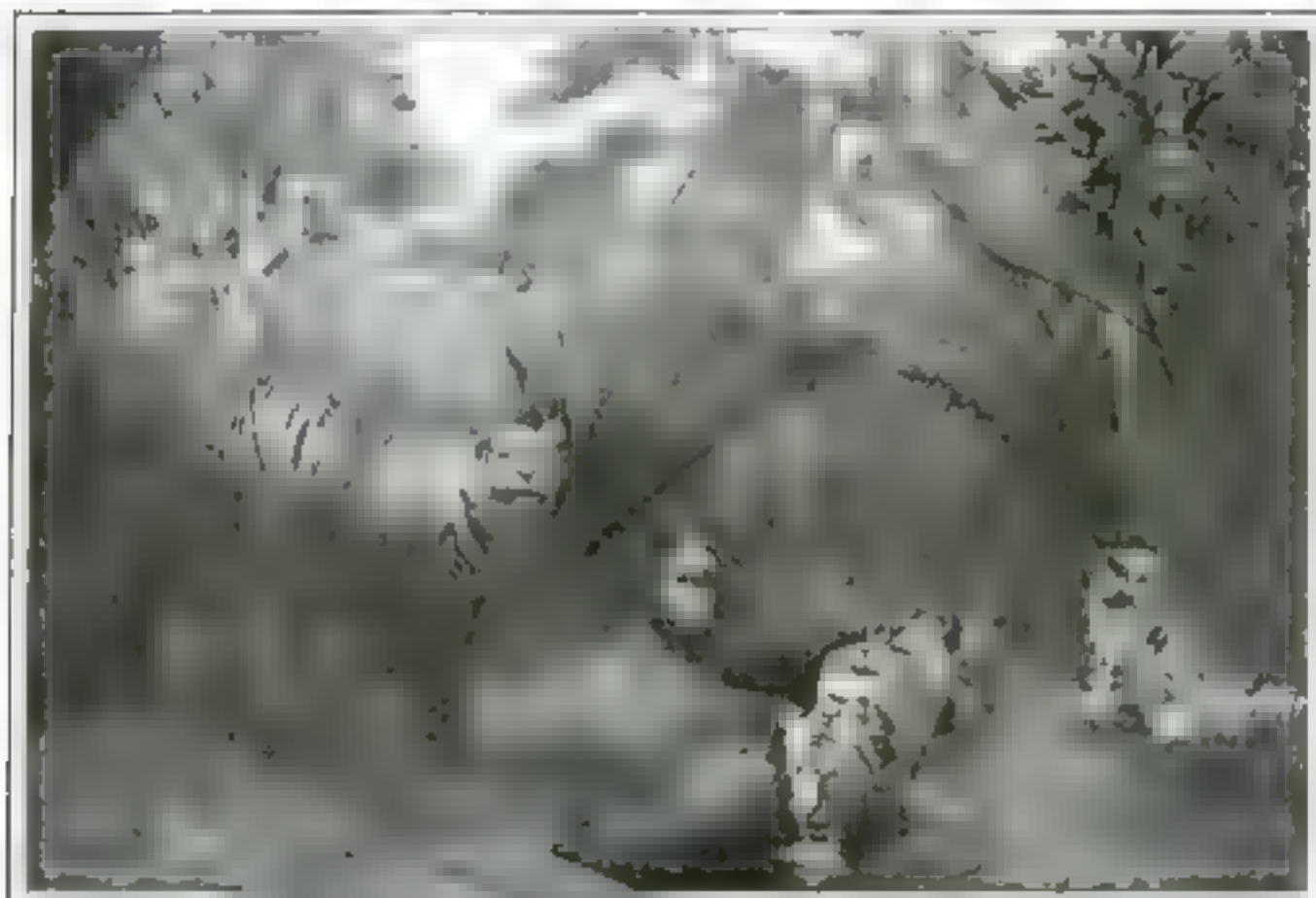
*Material Gathered from the Ends of the Earth Gives a Realistic Setting to Rare Natural History Exhibits*



Seventh step, the completed lion standing strong, permanent and lifelike. To exhibit him thus more work was necessary than would have been required to sculpture a likeness in bronze.



# Beasts Are Lifelike



REALISM IN THE  
MUSEUM  
The American Museum of Natural History, New York, has just opened its new exhibit of animals in their natural habitats. The exhibit is a masterpiece of realism, and it is the first of its kind in the world. The animals are arranged in groups, and each group is surrounded by a realistic background of trees and foliage. The exhibit is a masterpiece of realism, and it is the first of its kind in the world.

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James L. Carr  
The American Museum of Natural History  
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Carrying limbs of the Euphorbia tree back to the field camp. There the branches are photographed, casts are made, and color notes recorded, to aid in reconstructing the wood for the exhibit's background.







### ACCURACY OF BEARING AUTOMATICALLY GAGED

A new gage records on a dial face how much a bearing is out-of-round. Based on the principle that it takes a three-point contact to determine a true circle, any deviation from true causes a pointer to move to the right or left.

Red markers are placed on the dial to permit setting the gage to tell when the bearing is above or below a certain limit, the limit being a point midway between the markers. The markers are adjustable.

### TUNNEL TRUCK HAS TWO FRONT ENDS

Either end is the front end of an emergency truck with a reversible drive recently put into service in the new international tunnel between Detroit, Mich. and Windsor, Canada. It can dash into the tunnel and tow out a balky car without turning around. Two drivers sit at the novel truck's steering wheels, facing in opposite directions.

This machine also carries twelve chemical fire extinguishers of the hand type and one 600-gallon power-driven extinguisher, with hose and reel. On the chance of encountering dangerous gas it is equipped with gas masks and apparatus for reviving asphyxiated persons.



Designed for use in the new international tunnel between Michigan and Canada, this emergency truck, with two front ends, can go in and out of the tunnel without stopping to turn around.

### LARGE METER "WEIGHS" HIGH VOLTAGE CURRENT

Big brother of all the world's electric meters is a voltmeter just completed at the U. S. Bureau of Standards. Beneath its mushroom-shaped dome, forces up to 300,000 volts of electricity—the power that lies behind sizzling two-foot sparks of small-scale lightning—may be measured with hairbreadth accuracy.

This is the first available precision instrument to measure these voltages, though such an instrument has long been needed to check the accuracy of power transmission over standard 220,000-volt lines. In order to measure precisely extremely high voltages, the designer, Dr. H. B. Brooks of the Bureau's staff, devised an instrument that literally "weighs" electric voltage.

When the voltage is applied to two metal plates in the machine, a circular metal disk hanging in the center of the upper plate becomes charged and is attracted to the lower one. From a platform eight feet away, an observer works controls that add weights to the balance that carries the disk until he sees through a telescope that it is level again. The number of weights he must add indicates the voltage.



Safe from stray sparks, an observer reads the big meter.



Electric meter that measures up to 300,000 volts. Diagram shows how the meter "weighs" voltage.



This log now serves as a garage for a tractor used in a California park.

### GIANT HOLLOW TREE IS TRACTOR'S GARAGE

A new use has been found for a huge hollow log in Balch Park, near Portersville, Calif. It serves as a garage for a small tractor used in improving the park grounds. The photograph above shows the tractor entering the log.

The remarkable relic, seventy-five feet long, has an opening fifteen feet in diameter. The interior is completely burned out from one end to the other. Park officials are carefully preserving it, after it has already survived many strange uses. Campers have frequently found shelter in the hollow tree, and now the fallen giant's rest is daily disturbed by the chug of the tractor going in for the night.

## ONE-HUNDRED-TON BOAT IS LOADED ON LINER

One of the greatest lifting feats ever performed in shipping was accomplished recently at the mouth of the Thames River, in England, when the 100-ton steel motor tanker, *Itaco III*, was hoisted bodily aboard the liner *Beljeanne*. Although the big boat listed over as the load came aboard her own derrick proved adequate for the task. Safely aboard and stowed on the top deck, the tanker was soon en route to Buenos Aires, its South American destination.



A one-hundred-ton steel motor tanker is lifted bodily by a big liner's derrick and hoisted on deck for shipment from England to Buenos Aires.

## CLOSED AUTO DRIVERS VICTIMS OF NEURITIS

Driving in a closed car, with a front window open for signaling, may lead to neuritis, according to a recent report to the American Medical Association. Cold lamp weather increases the likelihood of contracting it in this way. Sufferers experience pain about the shoulder and neck, on the left side only. Medical authorities explain that air from the window circulates in a draft past the driver's left shoulder, and it is this local chilling that causes the ailment. Drivers of open cars are not affected, the report states.



## SAFETY OPENING BORED IN BIG WESTERN DAM

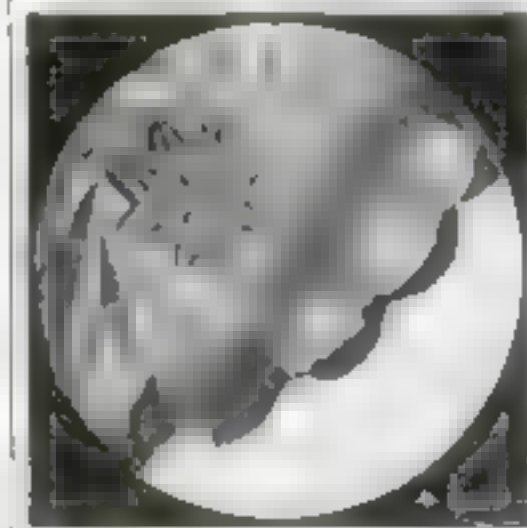
WORKMEN are engaged in carving a hole through Mohican Dam, near Hood, Calif. This unusual operation is the purpose of providing a new spur for the structure. It will act as a "safety valve" by allowing surplus water behind the dam to escape.

The dam is a part of the city's water supply system of the city of Los Angeles.

The spot at which the Mohican Dam is being bored has long been one of the most beautiful in the West. In order to get so close to it, it was necessary to erect a scaffold on the face of the dam from which workmen operate the drills that cut their way into the rock. In the photograph above, the upper portion of the bore can be seen.

## NEW LAMP DISCOVERS STRAIN IN GLASSWARE

None of glassware ever failed to shatter in your cupboard? It is strange that the glass was cooled unevenly in the factory and that it is pitted by the action of the atmosphere. To



At top, the shadows of strain in cut glass, due to uneven cooling in the factory, show plainly when lighted with new lamp which, above, is being used to find flaws in bottles.

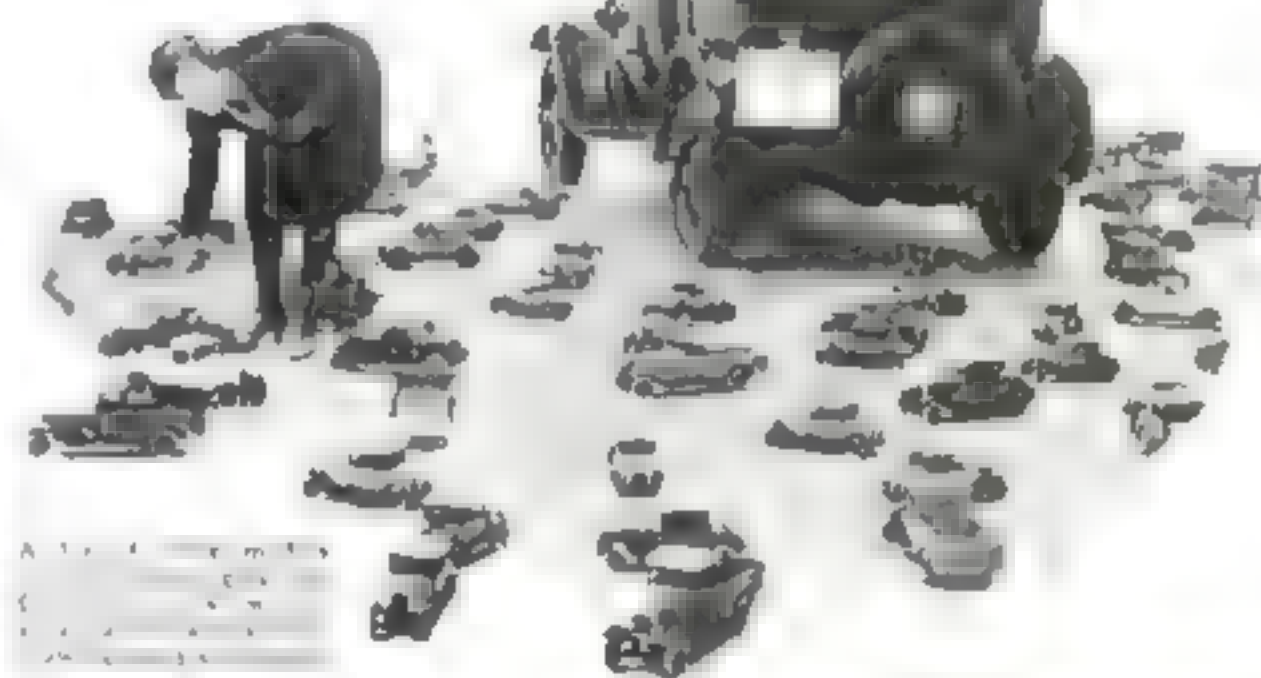




## ARMY TARGET PRACTICE NOW USES TINY RIFLES

Army target practice has "gone miniature" for the Ninth Infantry at Fort Huachuca, Texas. Air guns and .22 caliber rifles have been substituted upon the range for the large guns of thirty-seven caliber guns fired instead of the large ones.

To make firing more realistic, a tiny town with houses, factories, Army trenches and a bridge has been constructed. When hit by shot or 22 bullets strike the dry ground and throw a spray of the grains, giving the effect of the bursting of a one-pound high explosive shell. The target is viewed through the larger gun's regulation sight.



## FIND RARE THORIUM IS POISON ANTIDOTE

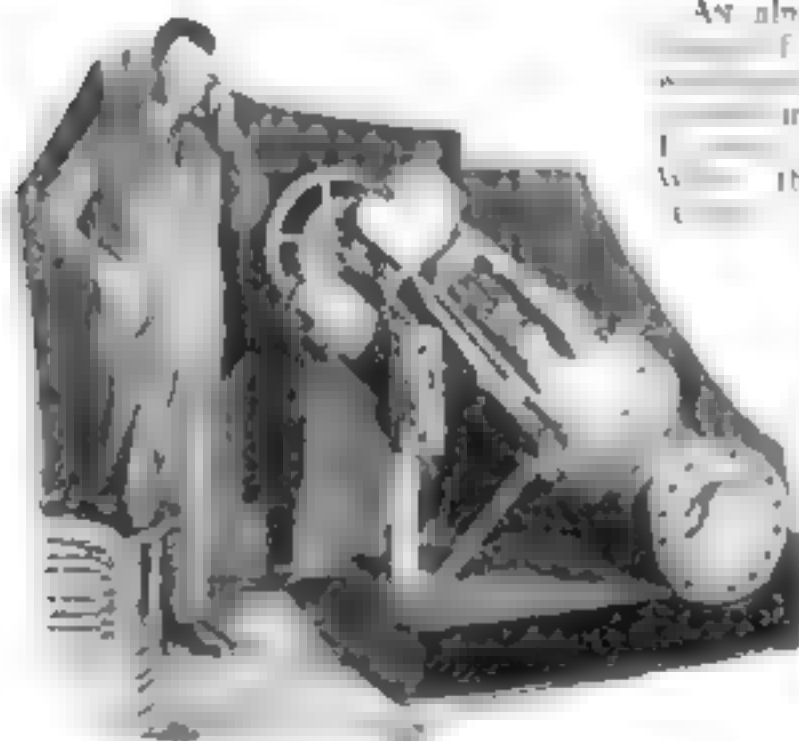
THORIUM IS A RARE ELEMENT

Three French scientists were reported recently to have discovered that thorium is a powerful antidote for the most common form of poisoning.

## MINIATURE CAR MODELS USED IN SHOWROOM

MINIATURE CAR MODELS USED IN SHOWROOM

## BIG TURBINE VALVE OBEYS HUMAN VOICE



An almost-human servant of men in the power plants is this new valve, which controls the flow of steam into large turbines in response to spoken commands. It is operated over a telephone. When the dispatcher says "Open" or "Stop," the valve obeys his voice. The voice actuates a set of electric relays, through which the electric motor that turns the valve is controlled.

## CHINA LIKES OUR HOMES

AMERICAN styles of wooden homes and buildings are becoming increasingly popular in China, says a recent report of the National Committee on Wood Utilization. Traditional pagodas are giving place to houses of American design and materials.



## POCKET CLIP FITTED TO CIGARETTE LIGHTER

A cigarette lighter that cannot fall out of the owner's pocket is fitted with a clip like those on fountain pens. The new lighter, with its ingenious pocket clip, is small and flat, taking up but little room in the pocket. In spite of its small size it can be used for about a week on one filling of fuel, according to its makers. Another advantage of the clip is that it keeps the lighter upright in the pocket, lessening chance of leakage.

Payne Dean, New York City, with his recently invented steam valve that responds to spoken words

## ART BRINGS BEAUTY TO DESIGN OF ELECTRIC LOCOMOTIVES



In the future electric engines may have all the beauty of the cars now have as artists are designing them.

Art is applied to locomotive design in the new art-engineering department of the Westinghouse works at East Pittsburgh, Pa. Skilled artists make small clay models of electric locomotives under construction at that plant and after these are altered until the best looking engine is obtained, the model serves as a basis for the exterior design. The same staff of artist-sculptors helps to design other forms of electrical machinery as well as locomotives.

For a long while art has been an important factor in the design of motor cars but its application to the design of heavy machinery is unusual. As a result the electric locomotive may soon be a sleek, trim monster, with all the shining gracefulness of a luxurious limousine.

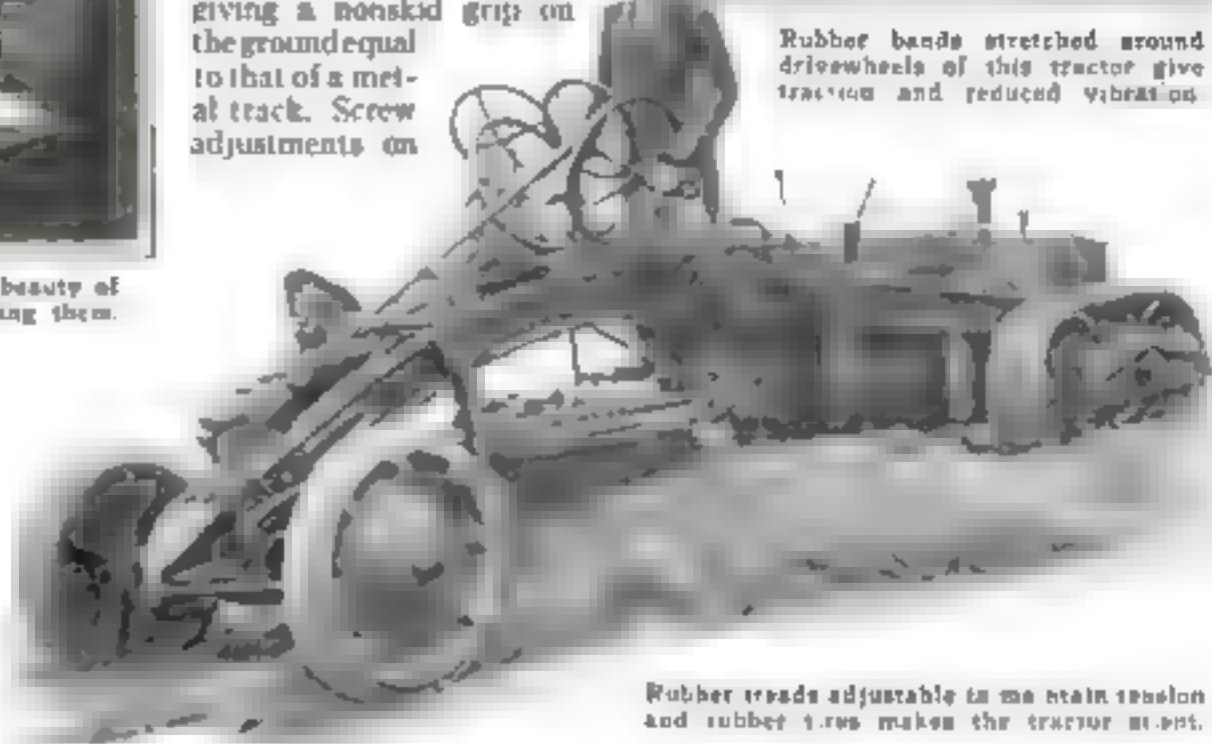
The picture shows Donald R. Dohner, left, director of the art-engineering department of the Westinghouse company, drawing a design for a new development in accordance with the principles of art and proportion. At the right, Sidney Gould Warner is making a clay model

## NEW TRACTOR HAS RUBBER TREAD

A TRACTOR that crawls on rubber bands instead of metal tracks and which also shows marked differences in the design of the supporting frame recently was developed at Bucyrus, Ohio. Huge triangular-shaped bands of rubber are stretched over its driving wheels on each side, deep grooves in their surfaces giving a nonskid grip on the ground equal to that of a metal track. Screw adjustments on



Rubber bands stretched around drive wheels of this tractor give traction and reduced vibration.



Rubber bands adjustable in the chain tension and rubber tires make the tractor silent.

the driving wheel axles permit their center distance to be increased in order to tighten the crawler belt and maintain tension. Solid rubber tires on the front wheels also further reduce vibration and noise in operation.

Rubber crawlers allow the use of tractors on paved streets without fear of damage to the highway. They are also quieter in operation than steel-treaded machines and their manipulation under ordinary conditions is said to be satisfactory.

## "STOLEN" SIGNAL WARNS OF AUTO THIEF

HARRY indeed is the thief who would risk driving away in a car equipped with a new anti-theft signal invented by a mechanic of Pittsburgh, Pa. At the first application of the brake, the word "STOLEN" appears at the rear in brilliant blue-green letters. The owner of the car upon parking it sets a secret switch that operates the device.

## AIR PROPELLER ON FLAT-BOTTOMED BOAT

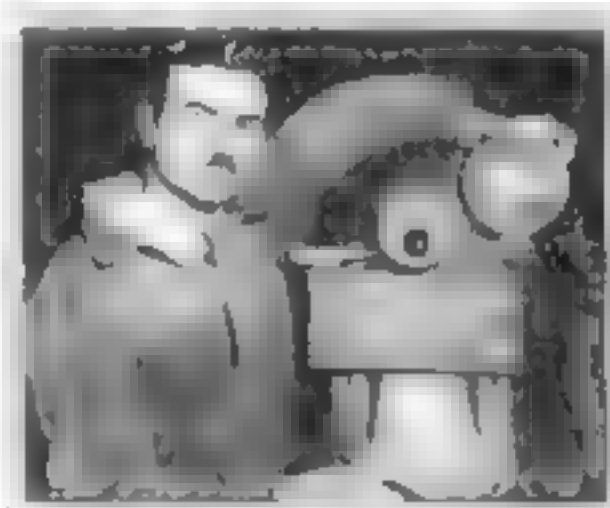


Hubert Richmond, of Miami, Fla., in his flat-bottomed boat to which he fitted a motor-driven air propeller.

AN "AERO" motor of his own construction enabled Hubert Richmond, of Miami, Fla., to convert his rowboat into a motorboat and still use it in water so shallow that it will barely float the boat.

From a discarded, twenty-two-horsepower motorcycle motor and an air propeller, he built a power unit that is clamped to the stern of his rowboat. A tiller handle similar to that of an outboard motor steers the craft by turning the air propeller from one side to the other. On a straightaway the "pusher" propeller drives the boat at a thirty-nine-an-hour clip.

The motor is detachable and portable. A counterbalanced built-up crank shaft has been substituted for the flywheel ordinarily found on motors of this type. Richmond, an inventor, claims originality for his device.



Frank Blara, Pittsburgh, Pa., exhibits his device intended to prevent stealing of cars.

## HOW CARS ARE WRECKED

MOTORISTS who crowd around wrecked cars frequently cause additional accidents, says Robbins B. Stockel, state commissioner of motor vehicles. Connecticut Automobile wrecks generally occur at points on highways where the vision of drivers of approaching cars is obscured and crowds increase the danger. If help is on hand, motorists should keep moving.



## TANK CAR CONVERTED INTO FIRE ENGINE

WHILE Federal agencies were perfecting the methods of fighting forest fires described on another page of this issue an Aberdeen, Wash., logging firm converted a gasoline tank car into an ingenious fire engine of its own.

The unique car can fight fires in three ways. Nozzles like those of a fire boat, on top of the car, may be aimed in any direction to spray powerful streams at near-by flames. More distant fires are fought with hose, unreeled from the car. A sprinkler system beneath it showers water upon blazes under the ties of bridges, or in brush alongside the rails. Water pressure is supplied from the locomotive that pulls the car. The tank has been fitted up with a number of large water lines in which the pressure is sufficient to throw water over a hundred feet on each side of the track and thus furnish efficient protection to the company's right of way. The sprinkler system is an especially important feature, as with it water can be thrown on blazes at near-by bridges.

## GHOSTLY UNIFORM FOR BRITISH POLICE

MASKED riders in black now roam the streets of London on any rainy day. A speeding motorist finds hooded apparition that draws up beside him is a motorcycle officer, clad in the latest rainproof uniform. The headgear protects the rider's face while a visor shields his goggles from the rain.



Ghostly apparitions, clad in ghastly attire, are familiar sights in London as motor cops don this rainproof uniform.

## CEDAR VAPORS SOFTEN PAINT

CEDAR vapors, unhealthy for mouths, also are unhealthy for paints, according to recent discoveries of the United States Department of Agriculture. They act as slow solvents of drying oils used in making the paints, softening them to a point of

## NEW ELECTRIC TRUCK STEERED WITH FEET

THE operator of a new German industrial truck stands on a small platform mounted on a horizontal axle. Tilting it to one side or the other by pressure of his right or left foot steers the vehicle to right or left as desired, leaving both hands free to control power and brakes. Steering by the operator's platform in this fashion makes a compact machine, with the greatest amount of loading capacity on the shortest wheelbase and turning circle.

The operator finds no difficulty in maintaining his balance upon the steering platform even on turns, because he has only to respond to the natural instinct to lean in the direction of the turn, exactly as a skilled rider does in guiding a horse. The foot-steered truck, it is claimed, materially increases the efficiency not only of the operator but of the machine itself.



The operator's hands are freed from task of steering this truck, which is guided by feet.

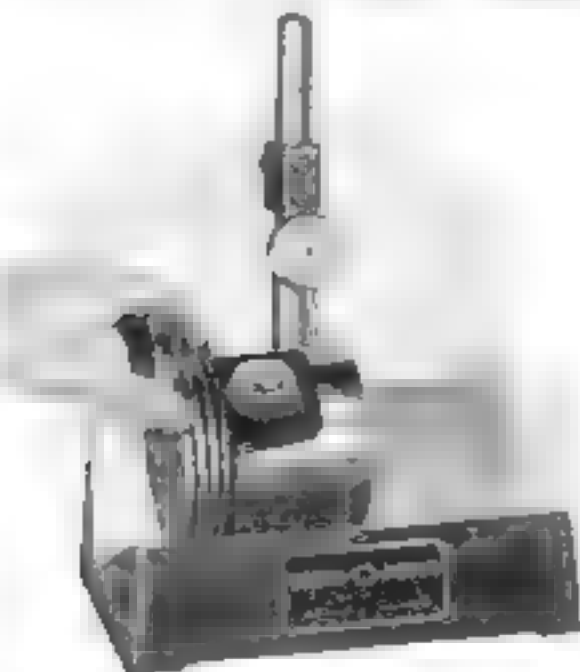
## TOOL CHECKS OBJECTS' SHAPE AND SIZE

A NEW tool for checking shape and size of any spherical object, from three fourths to six inches in diameter, accurately indicates inaccuracies in half thousandths of an inch. It makes possible the rapid checking of pistons, bushings, sleeves, and pins. The part to be checked is slid into the V-base of the tool and revolved slowly. The dial shows the shape and contour of the part and registers inaccuracies.

## COFFEE FILTER IN POT

A NEW German filter permits ordinary coffee or a caffeineless beverage to be poured from the same pot. It is made of black material resembling blotting paper, which contains specially-treated charcoal, similar to that used in gas masks to absorb poison gases. The filter is used when pouring coffee for those who object to caffeine.

This tool checks shape and size of round objects. It is used by the U. S. Navy.



Shape and size of round objects are determined to one half thousandth of an inch by this tool.



## FILMS PUT CRIME IN FAR EAST ART

It is a long way from America to H. I., a little island adjoining Java in the Dutch East Indies, where brown-skinned natives still in the 19th century. But now and then a ship visits here with a few reels of Western movies, and the natives flock to see them. On the wall of one of their temples may be seen the effect of the movies on their minds.

As automobiles, bicycles, and airplanes have been carved in stone on the temple walls, in company with native figures of gods and demons. One scene even depicts an armed gangster holding up a car in traditional bandit manner.

Frequently an earthquake damages a temple wall, and when a new one is substituted it is decorated by a volunteer artist in stone. Evidently the movies furnished several with their inspirations.

H. I. is only seventy-five miles long with



a population of 525,000. The natives are credited with being of a superior mentality and already had reached a high stage of culture when the Dutch took over the little island in 1849. They are especially adroit at sculpture and the walls of their temples are always elaborately decorated.

The photographs above show a few samples of the carvings on the temple walls.

## LIGHT IN STOVEPIPE GUARDS WATER TAP

A piece of old stovepipe and a small electric light bulb form an antifreeze combination that saves the water pipes in the poultry yard of a poultryman near Lafayette, Ind.

The discarded stovepipe is placed around the water tap and, with the lighted electric bulb inside it, the top is covered with a heavy sack to prevent the heat from escaping. When thus protected the tap will not freeze even in the coldest weather.

## CAMERA ON POLE SNAPPED FROM GROUND



This German invention is the form of a telescopic pole raises a camera above an obstacle to snap an otherwise hidden view.

MANY an amateur camera user has wished at some time that he could climb to an elevated vantage point to snap a scene over crowds, tall fences, or other obstructions. Now a German invention, a portable "stilt" for the camera, makes such shots easy. A telescoping pole with a tripod screw at one end to hold the camera and a foot rest at the other to steady it holds the camera high aloft while the photographer works it from the ground. One model, designed especially for amateurs, becomes disguised as a cane for carrying. A professional model has no such refinement, but additional sections give it greater height in the raised position.

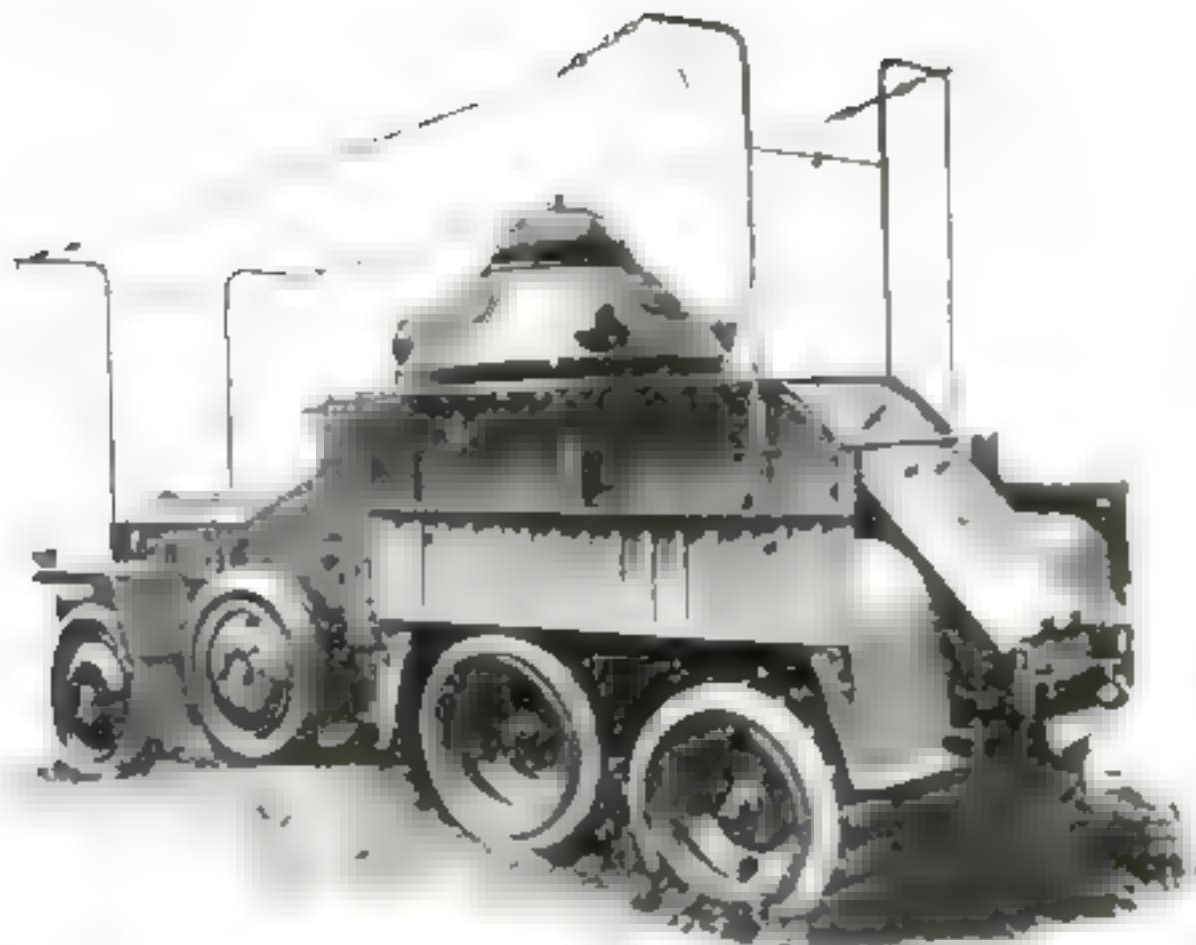
## TAXI LIKE HANSOM CAB

TAXICABS with engines at the rear and drivers sitting on elevated seats may revive the style of the old-fashioned hansom. Sir Herbert Austin, British motor car manufacturer, suggests that cabs built along these lines might help to solve the traffic problem. Putting the engine at the rear would result in a car with much shorter wheelbase than those used at present.



H. W. Pitting, poultryman, Lafayette, Ind., guards water tap with light and stovepipe.





### NEW ARMORED CAR IS RADIO EQUIPPED

A GROTESQUE, humpbacked vehicle is the newest in armored cars, recently adopted by the British army's tank corps. Six of its eight wheels usually suffice to carry it over the ground, but a spare pair is pressed into service when it encounters extra rough going, as seen in the photo.

An added touch of oddness is a radio aerial strung on four L-shaped standards that enables the occupants of the car to keep in touch with their base during all operations. This novel use of radio was recently proved feasible in British tests of a wireless set installed in a tank (P. S. M. Jan. '31, p. 71). The apparatus consisted of portable receiving and transmitting sets.

### GIANT DITCHER KEEPS 40 TRUCKS BUSY

EXTREMES in the size of mechanical iron diggers are in operation at Los Angeles, Calif., and Aurora, Ill. What is needed to be the largest is a ditcher.

large pipe line in the Jefferson Storm Drain District near Los Angeles. The big-

mechanical monster excavates more than

g the earth away.

Only one man is required to

which was recently developed at Aurora, Ill. This

### PENCIL PROTECTOR CLIP IS A SMALL HAMMER

A PENCIL becomes a small hammer with the addition of a novelty clip at its end. It makes a really practical instrument for hammering small nails, tacks, or pins, and is useful for framing pictures and for other light work. A long shank gives a firm enough grip to keep the hammer part of the device from twisting when a blow is struck. The clip also serves to protect the point of the pencil from breakage in the pocket when not in use.

With the aid of the combination tool lines may be marked for nails and the heads driven home without stopping to look for a regular hammer. The tip may be magnetized, if desired, to pick up brads or to hold nails for hammering nails in inaccessible places high above the user's head without the necessity of using a step-ladder or other support.



The metal protector clip on this pencil also serves as a light and convenient hammer.



Working on the Jefferson Storm Drain District near Los Angeles, Calif., keeps forty large motor trucks constantly busy.



And here is the smallest ditcher of them all swiftly scooping out a trench across an Illinois farm. It is capable of turning a ditch three feet deep and eight inches wide.



# The Architect Builds His Own House— This Home Planned for Comfort



A view of the room of the Robert M. Schoen, showing the fireplace, bookshelf, and French doors.

A view of part of the Schoen living room showing the fireplace, bookshelf, and French doors.

Stucco bungalow designed for his own use by Indianapolis architect shows how home quality and beauty can be had at slight cost.

By ROBERT M. SCHOEN

**I** WANTED comfort. That was the first factor I considered when I set out to build a home.

As a professional architect I knew that I ought to practice what I preach and therefore include all of the latest and most modern ideas consistent with the size and general plan of the house.

Considering the size of home I wanted and the necessity for designing it in keeping with surrounding homes, I decided that \$12,000 would be my price limit. I felt sure that I could plan a home that would fit in with neighboring houses and compare favorably with them, size considered, at that figure.

On these theories, I selected a stucco bungalow to accommodate my family of three. To use the word that best describes the structure to me, I wanted it to be "squatly." Right at the start I abandoned any idea of following a definite style of architecture.

When drawing plans for a house, regardless of its size, an architect must bear in mind the number of pieces of furniture that ordinarily would be used in each room. He must see the room as it will be outfitted and try to keep

his plans in harmony with the furniture that will go into it.

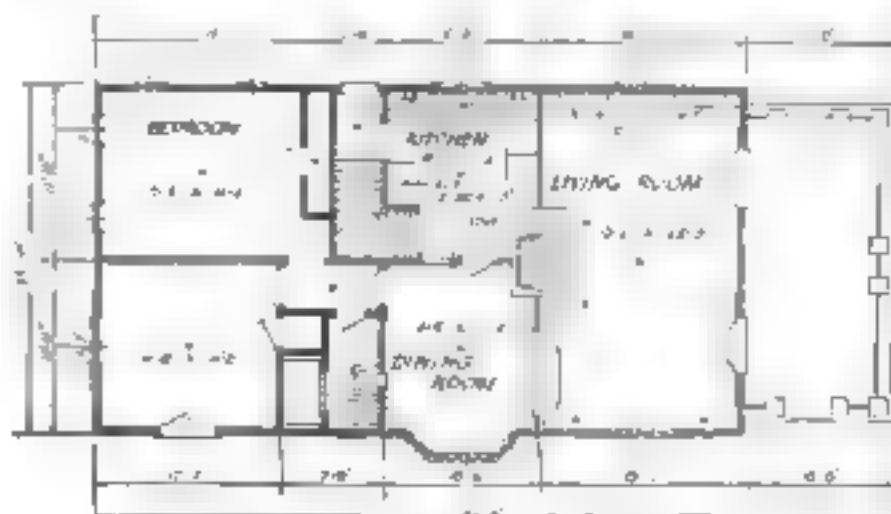
This plan probably savors of the crossword puzzle, but the results are astounding. I believe the system is worth a trial by any small home builder.

To begin with, I wanted a full-house width and a Colonial front porch. Rectangular in shape the lowness of the entire structure is emphasized by the thick grouped pillars at each end and the two in the center of the porch. A railing on the porch roof gives an ornamental balcony appearance.

In order to set off this exterior, I placed the house on the rear of the lot, allowing an uninterrupted view

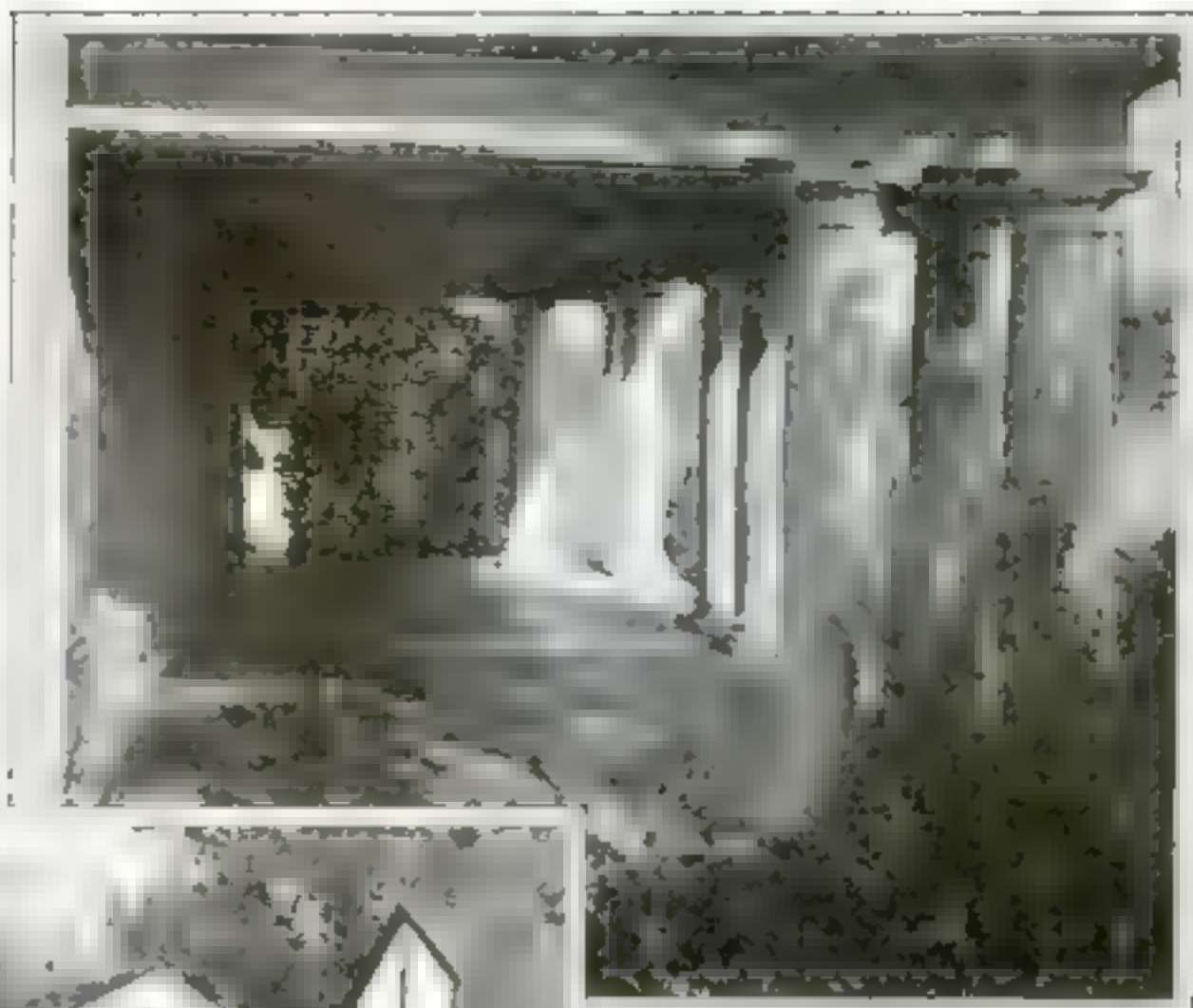
from the front broken only by a tree and a few shrubs.

Two flagstone walks join the drive to the two-car garage in the rear. One leads to the front porch and the other to an informal side and rear entrance through French doors to a bedroom.



First floor dimensional plan of the Schoen bungalow



[illegible]

2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Property rods and struts above the  
I also have  
from further  
each side of the

We have also included a table of the  
 results of the analysis of the data from the  
 first experiment. The results show that  
 the model is able to predict the results of  
 the experiment with a high degree of  
 accuracy. The model is able to predict the  
 results of the experiment with a high degree  
 of accuracy. The model is able to predict the  
 results of the experiment with a high degree  
 of accuracy.

As we have seen, the first two lines of the poem are a couplet. The next two lines are a couplet. The next two lines are a couplet. It has doors, two of them, and a way leading to the road. I am sure that the poem is a couplet.

1. The first step is to determine the type of refrigerator the customer is using. The most common types are mechanical and absorption. Mechanical refrigerators use a compressor to circulate the refrigerant, while absorption refrigerators use a heat source to drive the cycle. The type of refrigerator will determine the components that need to be replaced.

**AN ELECTRON** faces the challenge of saving space full of other electronic components. The solution is to use a surface-mount technology (SMT) that allows components to be mounted on both sides of a printed circuit board (PCB).

There are two small half-height windows and above the drains are built-in cupboards that drop to the top of the sinks over the drains, to merge with small cabinets above the windows. Large cabinets, with (Continued on page 138)



5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0  
5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0  
4 3 2 1 0 9 8 7 6 5 4 3 2 1 0  
3 2 1 0 9 8 7 6 5 4 3 2 1 0

the first of these is to use a heavy screen except for protection while the fire is burning. I



A view of the dining room as seen from living room. To break continuity the dining room is on a higher level. Note wrought-iron banisters at each side of the entrance.







K. E. A. M. T. A. M.



FROM: \_\_\_\_\_ TO: \_\_\_\_\_



WAC 40-09-00000 AR COOK A H...



T B A N T S J A N A  
D I E C M O N T H  
F O R U A G A N V E R S  
E A K Y I W A S  
V I E W S W I L L A N  
O F T H E P A T H O S T  
H O U S E E A T A  
C A N D I D A T E M A N

**MAKES RUGS STAY PUT** Accidents that occur as the result of slipping rugs are guarded against by the use of this liquid, right, which can be applied to the back of a rug in an hour. When dry the rug will not slip or come up at the edges. It is also claimed that the application of the liquid will not mar the floor or the rug and neither does it prevent the lifting of the rug for cleaning.

**POT HANDLE** Simplicity itself marks this lifter, at right, which is made of wire shaped to give a tight hold on a pot too warm to touch with the naked hands.

**STOPS UGLY BURNS** This is a holder clamps to the running board and is held in place by springs. A tapered, pointed edge makes it possible to slide the iron upon it with little effort, while ridges keep the iron from falling off. Asbestos lined the heat cannot burn through it.

# POPULAR SCIENCE MONTHLY



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ARTHUR WAKELING, Home Workshop Editor  
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## The Value of an Idea

**T**HE "chanciest business in the world," the head of the patent department of a great corporation told us recently, "is trying to estimate the present or future value of a new invention. Compared with this, predicting the future movements of the stock market is child's play and gypsy fortune telling is an exact science. Millions of ideas of men and women are commercial flops while simple improvements revolutionize great industries. No matter how seemingly important any invention may be to an industry its value may disappear overnight. Some new development may put the industry itself on the rocks."

Suppose, for example, someone had invented a better tone arm for phonographs in 1920. A couple of years after that came radio broadcasting and the whole phonograph industry went down like a flat tire. And what would have been the value of an improved type of "blind" typewriter just before the visible typewriting machine killed the sale of any kind of a blind model?

Then, too, there is always the risk of an invention being made obsolete by a sudden change in human likes and dislikes—a style change.

"Once you never saw anything but wood wheels on automobiles. Then everybody went wire wheel crazy. After a while wire wheels lost their popularity and wood and disk types were the vogue. At present the style cycle seems to be shifting back to wire wheels. Style changes being vagaries of the human brain often are without rhyme, reason, or common sense. They cannot be predicted in advance."

**H**OWEVER, let the inventor take heart. Since all life is pretty much of a gamble anyhow, the inventor is no worse off than other people. If the inventor fails to profit because of a new development or a style change, he merely shares the common fate of the people in the industry affected.

It is almost as difficult to classify inventions as it is to estimate their value, but broadly speaking, an invention must be a new or improved way of doing an old job or a totally new way of doing a totally new job. As to which general type of invention is likely to bring the inventor the most money it is impossible to decide. Sometimes a simple improvement will net its inventor many times the money obtained for a basically new idea that directly affects the lives of thousands of people.

The pages of POPULAR SCIENCE MONTHLY are filled with descriptions of both kinds of inventions. There is, for example, the latest news of the mercury boiler development on page 40.

Here we certainly have a new and revolutionary idea. It is not simply an improved method of boiling water into steam. It is, in effect, a new way to get power out of coal. Then on page 78 there is a story of the autogiro. This queer flying machine is radically different from the ordinary airplane. And it may, in the end, shove the ordinary plane into the discard altogether.

**O**N the other hand, the various developments, some of them inventions which have boosted the speed of an airplane from forty or fifty miles an hour to within hailing distance of four hundred miles an hour are, in the last analysis, merely more of the same thing, like a second helping of turkey.

In theory at least, it should be easier to determine the value of an invention that will make an automobile go faster or a machine operate more efficiently than to tell what a radically new invention is worth now or will be worth in the future. The prediction in the first case can be built on experience with the unimproved device. In the second case the possible ramifications of a new invention are quite unpredictable.

**T**HE phonograph industry, which the industrial patent expert cited, also furnishes an example of the unexpected use of a new invention. Groggy and almost ready to go down for the count in the battle with radio, the phonograph was brought back to healthy life by the unexpected use of an invention produced by telephone engineers for quite another purpose. Their invention of the exponential type horn gave the phonograph a new and far better tone. And the further application of scientific sound principles developed in telephone engineering laboratories, combined with developments forced by the growth of radio, resulted in the "talkies." Here, too, scientific invention and development gave a new lease of life to an industry in the grip of a serious depression—which was the state of the silent film when science gave them a voice.

If you wish to do a little scientific fortune telling on your own account, consider television and try to figure out when, if ever, we may expect it in a practical form.

Theoretically, television is possible now if cost is not to be considered. But so far engineers have run into a stalemate in attempting to convert the known theory into a practical system. Here, at least, is one branch where an improvement on known apparatus is not likely to amount to much unless a totally new invention allows the whole problem to be attacked from a new angle.

**A**PPARENTLY the essential difference between a successful inventor and the threadbare gentleman with a long string of worthless patents in his name lies in the manner each man goes at his job.

The successful inventor may become completely absorbed in his idea, but he never loses his hard-headed common sense. He masters the fundamentals of the subject with which his idea is concerned and he saves time and wasted effort by finding out what others have done before him. In spite of his enthusiasm he tries to view his work with the coldly critical eye of the ordinary man, knowing that it is the verdict of the average man that will make or break his invention.

The unsuccessful chap becomes so wrapped up in his idea that he loses all sense of proportion. The value of his idea becomes exaggerated in his own mind and he may, in the end, fly off at a tangent and invent something of no possible use to anybody.

If inventing is the "chanciest" business in the world, then the way to make a go of it is to apply to it every ounce of brains, common sense, and vision you can scrape together.

## Blames It on the Moon

**S**CIENCE continues to shatter our pet illusions. Clock makers believed that if you could get a clock pendulum that wouldn't expand or contract with temperature changes and you could put the pendulum in a vacuum chamber and drive it with a frictionless mechanism, the clock would tell accurate time.

Now along comes Dr. E. W. Brown, of Yale University, president of the American Astronomical Society, and proves that if you had such a clock it couldn't keep accurate time anyhow. He has found that the pendulum of a clock is pulled first one way and then the other by the attraction of the moon.

However, as he says that the error thus caused is only about fifteen hundred-thousandths of a second in twelve hours, we don't think it would serve as a good alibi for being late to work!





Here the primary and secondary coils of an intermediate frequency transformer are under examination. These are the kind that are used in the superheterodyne circuit.

# Why Your Radio Fails at Knife-Edge Tuning

By ALFRED P. LANE

**J**UST why should the broadcasting from station XYZ be heard only when you have the dial set at a given number? Why don't the other stations come in at the same point? And why do the near-by local stations spread over many degrees on the dial of a set that is guaranteed to tune sharply?

Many a radio set owner has wasted hours of his own and the service man's time just because he didn't know the answer to these questions. Many a radio set has been unjustly condemned and its owner has become thoroughly dissatisfied for the same reason.

The difficulty arises in a general misunderstanding of what is and what is not possible in radio circuit tuning. The terms "hair-line selectivity," and "knife-edge tuning" have no real meaning and even "ten-kilocycle separation" is possible only under very special conditions.

In order to understand what degree of sharpness actually is possible in the tuning of a radio receiver, it is necessary to form a mental picture of what happens in the tuning circuits.

**A**TTEMPTS have been made to explain what goes on in a radio tuning circuit by comparison with a tuning fork which can be caused to vibrate only by air waves of the proper pitch.

However, the comparison falls down when the radio fan tries to figure out just how a tuning fork resembles the coil and

condenser in the radio circuit, there being no points of physical similarity.

In any electrical circuit where alternating current is flowing, the current flow is



Are you sure you have the right coil for your set? The right coil is the one that will give you the best results. The one that is too large or too small will give you poor results.



retarded both by the electrical resistance of the wire and the electromagnetic reaction of the circuit. When current flows through a wire it sets up a magnetic field around the wire and this field acts to resist any change in the direction or intensity of the current flow. This electromagnetic effect is, of course, much more pronounced if the wire is arranged in the form of a coil because the magnetic field is much more concentrated.

**S**INCE the magnetic interference with the flow of current acts only when the current flow is changing, it naturally follows that the interference increases in proportion as the frequency of alternation is increased.

By itself the tuning coil in a radio tuning circuit would therefore act merely to cut down the flow of current. At radio frequencies which, in the broadcast band, run from 1,500,000 down to 350,000 cycles per second, this interference of the coil with the flow of current is quite pronounced.

Introducing the tuning condenser into the circuit changes the situation because the condenser acts in the opposite manner to a tuning coil. The more rapid the frequency of the current, the less resistance the condenser offers to the flow of the current. By a proper choice of capacity for the condenser it is possible to get a combination of coil and condenser that will present only a negligible resistance to the flow of current at some one frequency. As the frequency is changed either up or down, the resistance of the coil and condenser combination becomes greater.

**I**F, FOR example, you set up a coil and condenser that would allow a 1,000 kilocycle frequency to flow through practically unimpeded, current having a frequency of 1,010 kilocycles would also flow through in slightly diminished quantity. The greater the difference between the frequency of the incoming current and 1,000 kilocycles, the greater would be the resistance it would encounter from the coil and condenser.

You can see the difference, therefore, between a tuning coil and a coil and condenser combination. The tuning fork won't start to vibrate at all unless the vibration is precisely the pitch, whereas the tuning coil and condenser merely slow

Note the adjustment of the tuning fork.

Fig. 1

# Be Your Own *Expert* on Radio Troubles

By JOHN CARR

**M**ODERN electric radio receivers, although reliable, occasionally go wrong as do any delicate and elaborate pieces of machinery. And in most cases the owner can easily remedy the trouble in a minute or two without having to call in a radio service man.

Just as the average motorist knows what to do when the gasoline tank is empty or a tire has gone flat, so the radio listener can learn to diagnose and repair common and simple radio troubles.

The mechanism of a radio receiver consists of an intricate combination of wire coils, condensers, chokes, resistances, and so on. Most of this apparatus is stationary. Unlike the automobile in which wear on moving parts is the principal source of trouble and the ultimate cause for scrapping the vehicle, mechanical motion plays a small part in the life of a radio set. Difficulty with the rotating condenser plates is rare and trouble with a volume control, tone control, or switch is unlikely.

When your radio set ceases to operate as it should, you can be reasonably sure that the trouble is of an electrical nature either inside or outside the set. Since the set itself is built as a unit and carefully inspected in the factory by experts, the most likely place is outside the set.

**I**F YOU discover that your set will not bring in the station you want, start at the beginning and make sure that the broadcasting station actually is transmitting. Radio service men regularly respond to calls to fix sets when an SOS has ended the broadcasting or an accident has put a station off the air.

The easiest way to check these possibilities is to tune around in search of some other station which will indicate that the set is functioning. The reception of the usual amount of static when the volume control is turned up is another indicator.



Fig. 2 Don't hurry to call the service man. Maybe the station is not broadcasting.

This test also will tell you whether the antenna or ground is disconnected, a common trouble, because the modern shielded set always will bring in a lot of static when operated "wide open" on an antenna of even moderate length.

The first step, then, when the set fails to function, is to make sure that the broadcasting is going on and that the antenna and ground are connected and in proper condition.

Next see whether the set is being supplied with electric power. In the days of battery operated sets this was quite a job because many things could happen to a battery supply system. With an electric set, though, you know that the current

been dropped so violently that the shell was fractured and the wire connection to the prong loosened. The plug at the night has been stepped on and is held together with a piece of tire tape. In addition the wire is badly frayed. This plug functioned for a while but stopped carrying current in the middle of an exciting football broadcast.

**T**HE operation of any radio set is dependent on the vacuum tubes. Ordinarily, only two things can happen to them, one of which is bound, in the end, to terminate the life of the tube: It can burn out or it can become exhausted.

A burned-out tube can be found by inspection, as a tube that no longer glows is done for. An exhausted tube, on the other hand, glows as usual, but the chemicals on the cathode no longer produce the flow of electrons on which the operation of the tube depends.

Complete tube failure is easily located but tube failure through exhaustion may produce a number of vague troubles, difficult to locate, because exhaustion of the chemical elements may be only partial.

Among the list of vague troubles that may be traced to partial tube exhaustion are weak signals, fading, tone distortion, spotty noises, microphonic effects, and excessively long time

required for the set to get into operation after the current is turned on.

Generally the modern set employs four different types of vacuum tubes. The type 224 screen grid heater tube is used for radio-frequency amplification, the type 277 general purpose heater tube is used as a detector and first-stage audio amplifier, the type 245 power tube operates the last or



Fig. 3 Put a new tube in place of the one you believe may be bad and so locate the trouble.

supply in the house wires is adequate if the lights are burning as usual. However, you will want to know whether the current actually is flowing into the set. Figure 1 shows a likely

source of trouble—a broken or defective plug. The one shown at the left is in perfect shape. The one in the middle has



Fig. 1. Examine plugs to be sure set is getting power. Here are two bad and one good plug.





Fig. 4. The service man may be a wizard at his work.

power stage of radio amplification, at the type 240 full wave rectifier tube takes care of turning the high voltage alternating current into direct current to operate the high voltage circuits of the receiver. In many cases, it also energizes the field of the dynamic speaker.

**PARTIAL** failure of a 224 tube will reduce the radio frequency amplification and weaken the signal. Distortion also may be caused. If the electron flow drops below a certain point on the tube, in the last radio-frequency stage, it becomes overloaded on strong signals and passes only the peaks of the radio waves. Speech and music, under such conditions, take on a ragged and disagreeably harsh tone.

Partial exhaustion of the 227 tube in either the detector or first audio stage, or of the 245 tube in the last stage, results in poor power handling ability. In other words the distortion point is quickly reached when you turn the volume control to get more than weak volume.

The heater tubes, either 224 or 227, can be responsible for excessive time between turning on the current and the first sound of broadcasting. Frequently, when these tubes are approaching exhaustion, all sorts of queer noises will be produced before the receiver goes into action. This is particularly true if only one of the screen grid type 224 tubes is going bad. If the 227 detector tube is failing, there usually is a pronounced hum from the speaker during the heating up period. On the other hand, if the first audio 227 tube is weakening, there may

be a second tube and so on. If there is a change or improvement in reception results leave the new tube in the socket, throw away the old one, and get another new tube for further testing.

second tube and so on. If there is a change or improvement in reception results leave the new tube in the socket, throw away the old one, and get another new tube for further testing.

**BY THIS** method you can bring your set up to full operating efficiency at the minimum expense. Remember that while radio vacuum tubes may have a rated working life of 1,000 hours, that is, a shade less than three hours a day for a full year, the actual life in hours is not a fixed quantity like so many dollars or minutes.

Tubes may give out within a month or so or they may last for several thousand

The screen grid tube, because of the necessity for a flexible top connection, has led to one new type of trouble. The flexible lead may become chafed through at the point where it passes through the shielding if it is roughly handled. See Fig. 5. Be careful in changing screen grid tubes.

If following out these suggestions does not put the set in good operating condition, call in the radio service man, making sure you get one who is properly equipped. If he shows up at your house with an old bag full of miscellaneous pliers, screw drivers, and odd parts, you can be sure that no matter how much of a "whiz" he is at radio, he isn't equipped to determine, quickly and accurately, what is wrong with your radio receiver.

Figure 4 shows a service man testing the functioning of a radio receiver with the aid of a modern "set analyzer." The cost of such an instrument is from \$75 to \$150 or more and it is, consequently, hardly the type of equipment the individual radio set owner would be likely to buy. Such an instrument is, however, a virtual necessity to the professional radio service man. It enables him to determine quickly and accurately just what is going on in every circuit of the set and also tells him at a glance the condition of each tube.

While many radio dealers sell radio sets with a guarantee of free service for some stipulated length of time, the common practice is to make a definite charge for all service calls made after the time limit expires. Calls are charged for either at so much a call or on a time basis.

Therefore, it costs as much to have the service man come around and put the loose antenna wire back on the binding post as it does to have him locate some deep-seated trouble.

It may be well to point out that "tinkeritis" is just as fatal to good radio reception as it is to satisfactory motoring. Know your own limitations. If you are not skilled in radio do not tinker with the insides of the set. Make the simple tests and do the outside jobs listed. If your set still refuses to operate, call the service man.

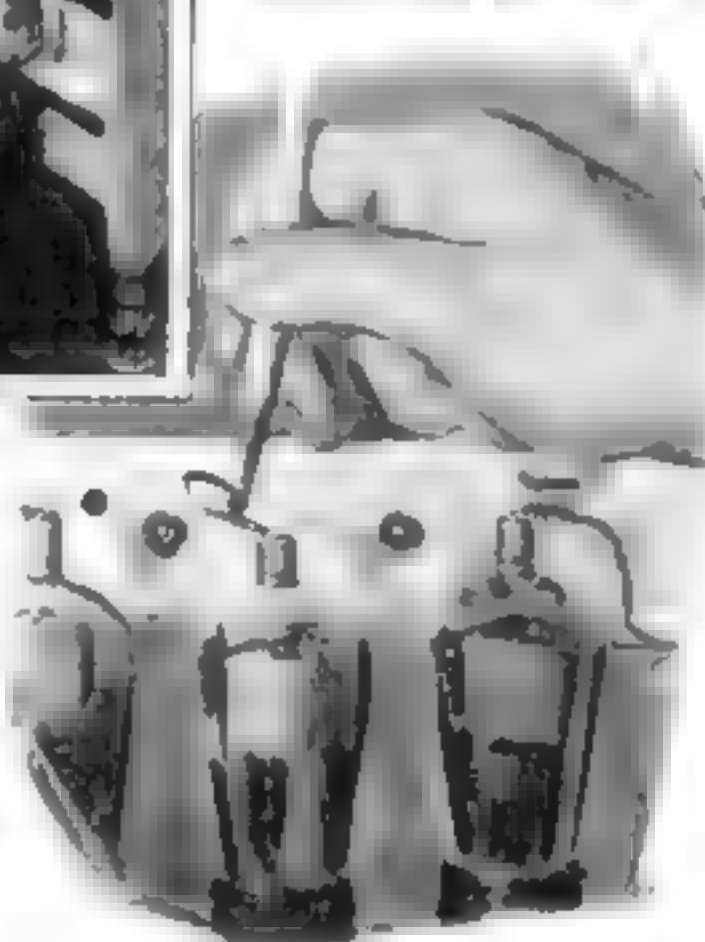


Fig. 5. The flexible lead on the screen grid tube may be chafed. Change these tubes carefully.

should have on hand one new tube of each kind used in the receiver. When the receiver begins to "act up," start with the first 224 and, the power being off of course, substitute your new tube as shown in Fig. 3. Try the set again and if there is no apparent change or improvement you are safe in assuming the 224 is still on the job. Shut off the set again, put the old tube back in the socket, and substitute the spare for the

## BEFORE YOU CALL THE SERVICE MAN

- 1—Make sure that the antenna is connected.
- 2—Check the ground connection; see that it is tight.
- 3—Look over the condition of the power plug.
- 4—Inspect tubes to see that all glow as usual.
- 5—Determine condition of tubes by substitution.



"Trouble is," Gus explained, "the battery gets pretty low because you don't drive enough in the daytime."

# Starting Tricks for Cold Weather

## Gus Tells You Secrets about Batteries, Hot Water, and Gadgets to Keep Your Car Ready for Quick Use

By MARTIN BUNN

**J**OHN WHIPTON, who lived out on the edge of town, was a steady patron of the Model Garage. He came regularly to have Gus Wilson, veteran auto mechanic and half owner of the establishment, inspect the car and check its condition.

Whipton was a fussy customer. He wanted things to be just right. And in spite of the fact that he had an absorbing interest in mechanical matters, he was, himself, possessed of no skill with tools.

Gus was not surprised when Joe Clark, his partner, came out of the office one winter morning to announce that Whipton was calling for help.

Whipton's appearance as he swung open his garage door after Gus had backed the service car down the driveway graphically suggested the trouble. He was coatless. Beads of perspiration stood on his forehead and a starting crank dangled from his hand.

"You're a fine auto mechanic, I don't think!" Whipton exclaimed. "Only two weeks ago I had the car at your place and you said it was in perfect condition. Now look at the darn thing—won't even start with the crank!"

"Where were you last night and the night before?" Gus asked.

"What's that got to do with it?" snapped Whipton. "Last night we drove over to

### Gus Says:

**WHEN** you buy new tires, put 'em on the front wheels if you have any regard for your own safety. Most tires end their lives in a blow-out, which is more dangerous on a front wheel. And the faster you drive the more chance there is that a front tire blowout will send you off the road or into a car coming the other way.

the other side of town to visit friends and night before that was lodge night."

"Hum-m!" said Gus. "I'll bet you left the car standing with the headlights going when you

"Sure I did," Whipton admitted. "But that shouldn't run the battery down."

"It wouldn't if you'd been doing any amount of driving in the daytime," Gus explained. "Trouble is, the battery gets pretty low because you don't drive enough in the daytime. Then the extra load of standing two nights brings it down to the point where it hasn't any snap left."

"It had snap enough to turn over the motor for quite a while," Whipton pro-

tested. "After it wouldn't turn any more I got on the crank. I won't tell I thought it would start playing phonograph music, and still nothing happened. What ought I to have done?"

**"MAYBE** if you'd cranked it by hand after the first couple of shots at the starter, it would have started. As it is said Gus, "you ran the battery down so far with the starter you haven't enough juice to make a spark hot enough to start a cold motor. Simplest thing now is to try the old reliable hot water method. Bring out a pail of real hot water and we'll get going."

Whipton came out with a pail of steaming hot water and after Gus had slowly poured it over the intake manifold, the motor started almost with the first effort.

"I should have had sense enough to think of that," Whipton grumbled disgustedly. "I'll chalk it on the wall so I won't forget it next time."

"What would you do if you couldn't get any hot water?" Gus inquired with a smile.

Whipton thought a moment. "I'll bite," he finally said. "What would I do?"

"Well," said Gus, "there's a lot of ways to get a cold motor started. Hot water is the simplest. But if you haven't any and there's a drug store handy, buy yourself a small can of ether. Pour a little in the air intake of the (Continued on page 115)



# THE HOME WORKSHOP



BETTER SHOP METHODS  
NEW IDEAS FOR  
THE HANDY MAN  
HOME WORKSHOP  
CHEMISTRY  
MODEL MAKING  
BLUEPRINTS  
SHIP SHAPE  
HOME



## Building an *Enterprise* Model

*Here's your chance to work from the original drawings of the world's greatest racing yacht*

By W. STARLING BURGESS

*Designer of the America's Cup Defender "Enterprise"*

AS I HAVE received countless requests for plans from which to construct a model of *Enterprise*, it gives me great pleasure that, with the consent of Mr. Vanderbilt, I am able to place simpler reproductions of the original drawings before the many ship model makers who read *POPULAR SCIENCE MONTHLY*.

In building a model it will be necessary first to decide upon a convenient reduction scale. Five such scales and the corresponding dimensions for the completed model are given in the table at the top of the next page. The hull can be built by the common "bread and butter" method of lifts, the sizes of

these lifts being obtained from the half-breadth plan. Cut away the extra stock on the glued-up hull carefully, testing the shape, from time to time with cardboard templates made from the lines given in the body plan. In studying the half-breadth and body plans, you will note that some of the original water lines and station points have been omitted. This was done for clearness.

For a sailing model, a deep fin keel having a large lead bulb on the bottom will be necessary. The weight of this can be obtained by experimenting with the completed hull, placing sufficient weight on the hull to sink it down in the water to the load water line.

While the drawings show the sails and rigging as they appeared on *Enterprise*, they can be altered easily to meet the requirements of a sailing model. For instance, if a jib, topsail, and staysail are used, it will be best if they are made narrower so



*Enterprise*—a yacht that has caught the fancy of model makers the world over.

There's a story back of this article. The editor knew that many readers would be eager to build a model of *Enterprise*, but yachting men to whom he turned for information were amused at the idea of publishing the authentic lines of the yacht so soon after her victory. It wasn't done—at least, it hadn't been in all the history of the Cup Races. So the editor went directly to the designer himself with a plea on behalf of model makers. And, precedent or no precedent, Mr. Burgess was willing to write the article himself.

that each sail will swing free of the luff side of the sail directly ast of it when a tack is being made. A boom also should be added at the foot of each head sail. Of course, as is the practice on many sailing models, a single jib may be used.

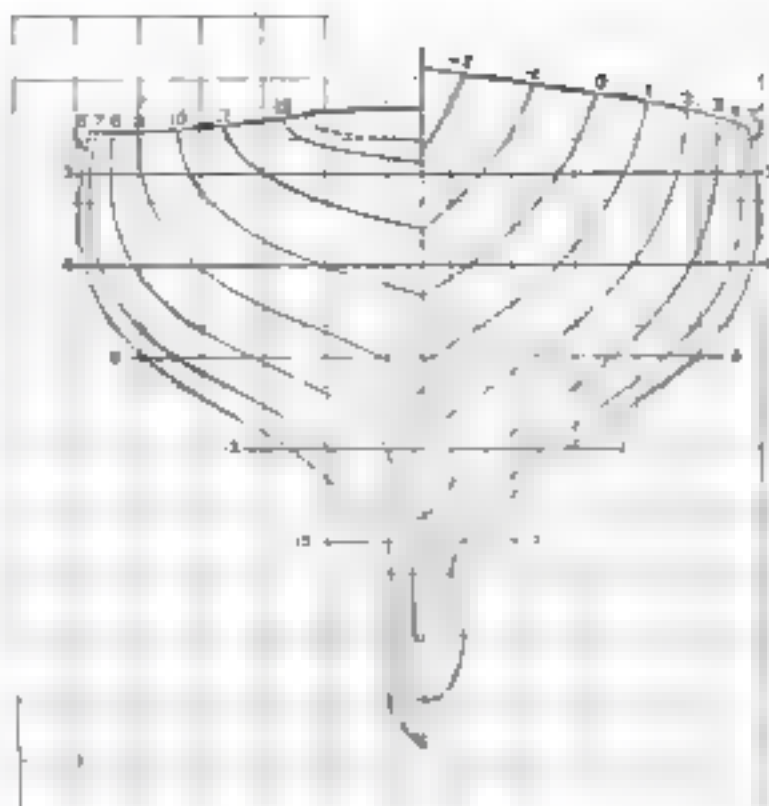
Aside from her metal mast, probably the most radical and universally talked of feature on *Enterprise* was her triangular section, sliding-foot boom. Although it would probably be difficult to incorporate this sailing arrangement on a sailing model, the triangular section can be retained.

As is customary on a sailing model, the main sheet should be rigged to the rudder in order to effect a semiautomatic control of both rudder and mainsail and an adjustable and convenient means for belaying the sheets should be supplied.

As to the deck fittings, these are shown in the drawings. However, on a sailing model it may be well to omit many of these.

*Enterprise* is painted white above the water line and left unpainted below. Since the hull was fabricated from bronze plates, this effect can be simulated on a model by painting the hull white above the water line and bronze below. *Enterprise* has no boot topping. The spars and the boom are white.

In order to make the model more real-



The body plan arranged in easy arrangement to the scale you wish to use. Each 10-inch square represents 2 by 10 ft.

istic, scribe lines along the deck for the planking.

As an additional courtesy, Mr. Burgess will have blueprints made up from his original drawings for those who are willing to defray the cost, which he estimates at \$10 (two blueprints 30 by 60 in. and one 16 by 22 in.).

Detailed instructions on model yacht building will be found in the book "Build a Winning Model Yacht" by Thomas Moore. See also the "Home Workshop Manual."

### Chart to Aid in Choosing a Scale for Your Model

Scale in feet	Overall length in inches	1 W L in inches	1 W L est. in inches	Approx. height of mast in inches
1/4	15	1	2 1/4	19 1/2
1/2	30	2	5	38 1/2
3/4	45	3	7 1/2	57 1/2
1	60	4	10	76 1/2
1 1/4	75	5	12 1/2	95 1/2



Sail plan of *Enterprise* with scale in feet. From this you can make a full size layout to the scale of your own model.



Drawings of the hull traced in somewhat simplified form from the designer's original plans with a scale in feet. For convenient reference, the body plan (given larger at top of the page) has been repeated.



## Stagecoach Cut in Sheet Aluminum Ornaments This Radio Lamp



The stagecoach silhouette is mounted in front of an illuminated sheet of ground glass.

**T**HE stagecoach model silhouette lamp illustrated is an original and most attractive ornament for use on a radio cabinet, mantel, or console table.

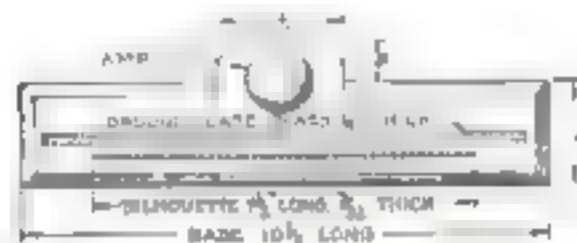
The silhouette, which is  $7\frac{1}{2}$  in. long, was cut from  $\frac{3}{32}$  in. thick aluminum. The design was taken from a previous article by J. W. Bollinger on weather vanes (P. S. M., Nov. '30, p. 94). I made a photographic copy of the required size from the drawing in the magazine and glued it on the aluminum. After all the cutting had been finished, the paper was soaked off in hot water, and the edges of the metal were smoothed with a file.



The base block is  $10\frac{1}{2}$  in. long. The glass for the lamp, which was ground to make it nontransparent, is  $\frac{1}{4}$ -in. plate with a  $\frac{1}{4}$ -in. bevel. Of course, the glass could be any shape or size desired. Both glass and silhouette are set in slots in the base.

When completed, the wooden stand and the silhouette were given three or four coats of copper bronze. A small golden glow bulb with an intermediate size base furnishes the light.—JAMES W. BLAIR.

*Copies of the November, 1930, issue can be obtained from the Subscription Department for twenty per cent.*



Top view of the lamp with dimensions, which, however, are offered merely as a suggestion.

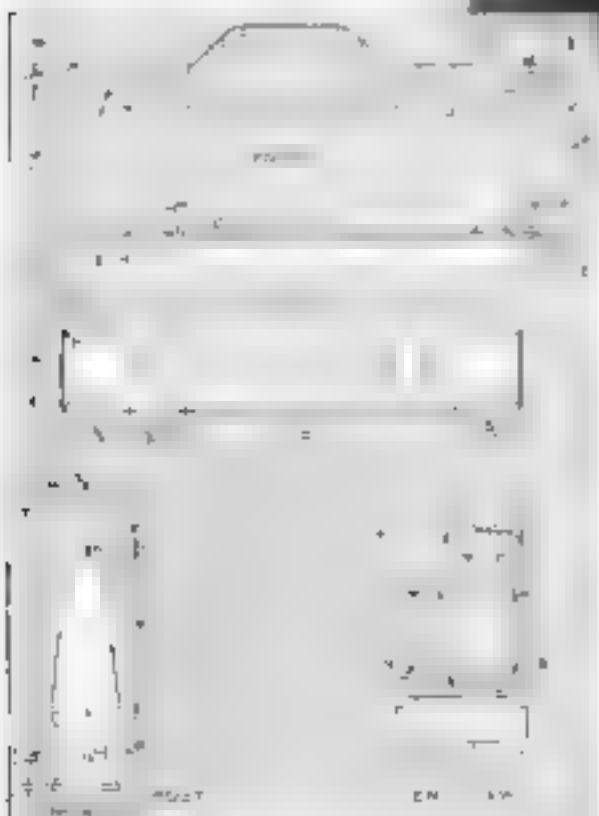
## How to Make a Handy Pipe Rack for Your Reading Table

**M**OST pipe racks are designed to hang on the wall, but here is one that will stand on the table near your chair, where you can reach it easily without having to get up.

While any wood may be used, a fine cut net hardwood is to be preferred. A piece  $1\frac{1}{2}$  by  $1\frac{1}{2}$  by 10 in. is required for the top of



The advantage of a table-type pipe rack is that it can be kept within easy reach of your favorite chair.



Front, top, and end views of the rack, and one of the turnings drawn to a larger scale.

the rack. Make a template to the form of the side view as shown, and trace it on the stock. With a fret or coping saw, cut out the form. Then locate the centers of the six holes and bore them with a  $\frac{3}{8}$ -in. bit. The small edge molding is now worked out carefully by hand.

The two small standards are next turned and sandpapered while still in the lathe. If a lathe is not available, tapered octagonal standards can be made by hand with a plane.

The platform is constructed from a 1 by 3 by  $10\frac{1}{2}$  in. piece. On the top surface an edge molding like that on the top is repeated on all four sides. The six small recesses for the pipe bowls are cut with a gouge, the cuts being made from each side toward the center to prevent splitting. In sanding this piece, take care that the out-

line of the trays, as well as the edging, is kept sharp.

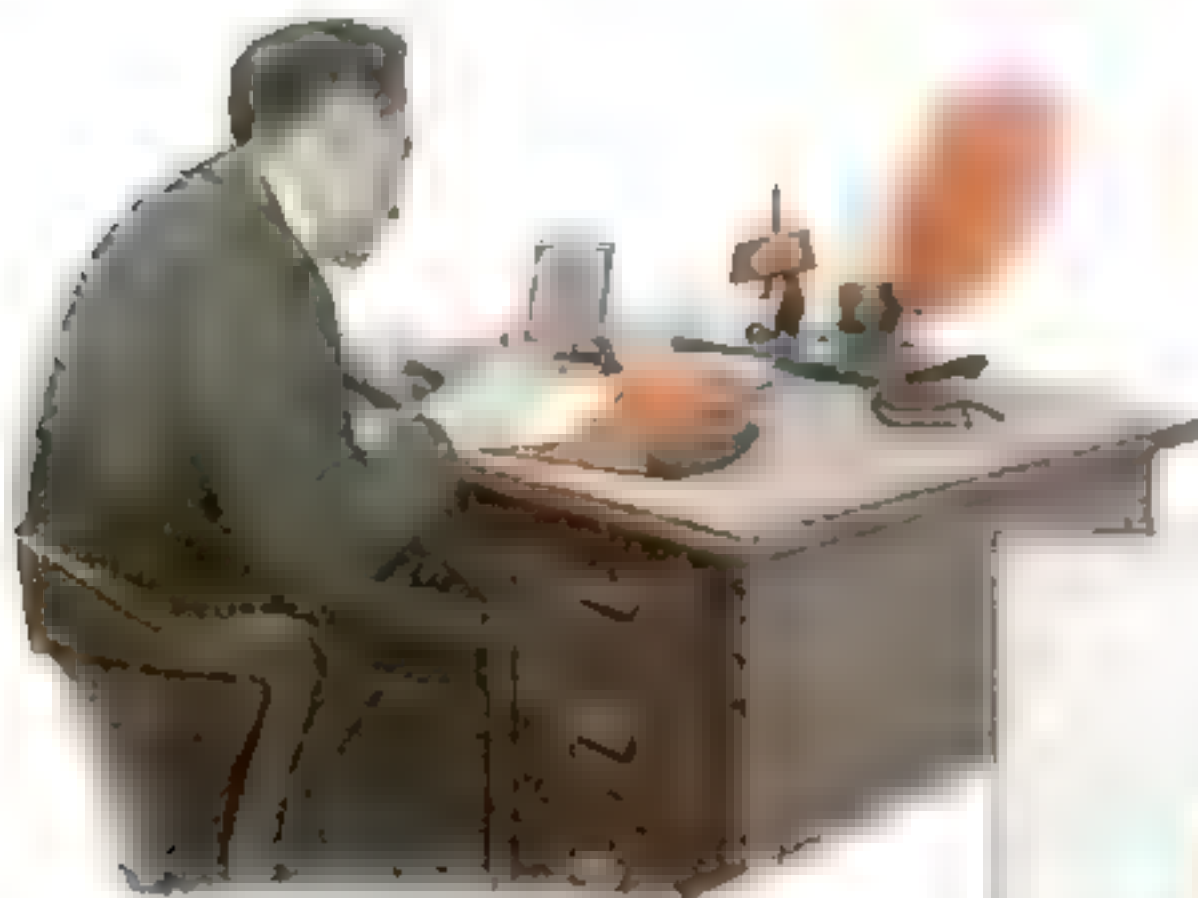
The rack is assembled with  $1\frac{1}{2}$ -in. brads driven through the bottom into the standards and 1-in. brads driven through the top. As hot carpenter's glue or a high-grade liquid glue is used in making all four joints, one brad through each will be found sufficient. Sink the heads into the wood with a nail set; and when the glue has hardened, remove all excess, and sandpaper carefully. Fill the nail holes with a prepared wood composition.

The finish depends upon the wood used. For a good cabinet wood, it is sufficient to use a coat of stain, an application of wood filler if the grain is open, and one or two coats of varnish. Glue a piece of green felt on the bottom to prevent it from scratching the table top.—E. T. H.

# For novelty you'll find it hard to match this

# Sir Walter Raleigh Desk Set

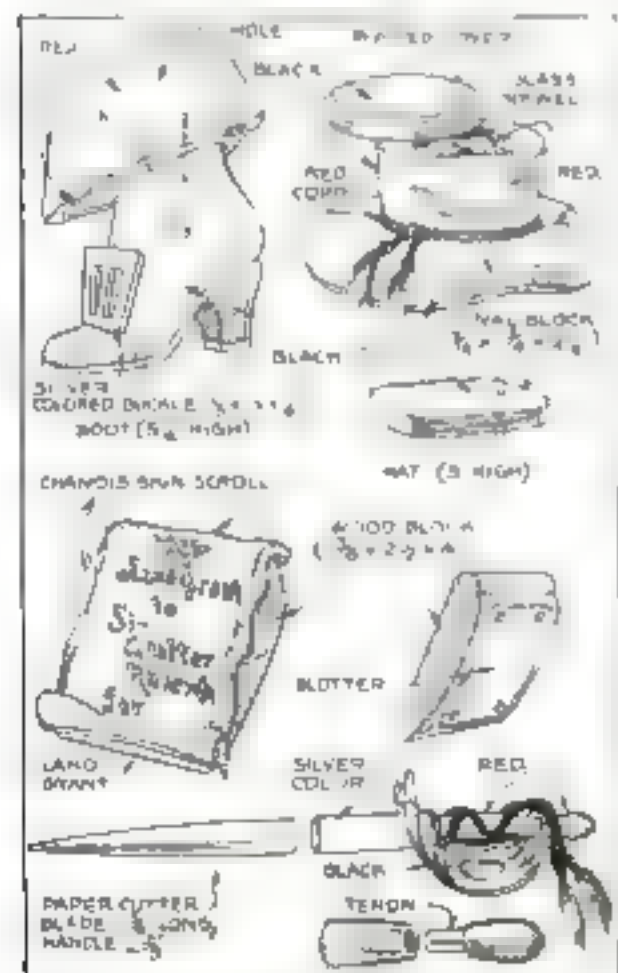
By CHARLES HERBERT ALDER



A novel and attractively colored desk set which includes an inkwell, pen and pencil holder, letter opener, and large desk blotter.

**T**HIS desk set is made up of the personal effects of Sir Walter Raleigh in miniature—one of his boots, his hat, his saber, his cloak (with the Queen's footprint still on it!) and the land grant that was given to him in recognition of his gallantry.

The boot is cut from a 4 by 4 by 5 1/2 in.



Sketches showing the construction of the boot, hat, land-grant blotter and saber.

block of soft white pine, spruce, or red wood or from a hardwood if you choose. On the block, sketch the side, front, top, and bottom views of the boot and then drill a 1/2-in. diameter hole to within 1/2 in. of the bottom. Next remove as much of the waste stock as possible with a hand saw or hand saw and then carve the boot to shape with either a knife or chisels.

The hat is made of two pieces as shown. Cut the crown or main part from a piece of 3 by 3 by 2 1/2 in. stock, and the brim from white pine 3/4 or 1 in. thick. When the crown has been carved to shape, cut off the top, and drill and chisel a hole to take the glass inkwell. The top is pivoted on a short nail driven into the top of the lower part of the crown. The wrinkles on the brim and crown can be made with a round file.

Nail or screw the crown to the brim and then drill a slanting hole for the quill on one side of the brim. This plume or quill can be obtained in the ten-cent store.

The base is a board 6 3/4 by 14 in. with rounded corners and beveled edges. Drill a hole in the baseboard directly under the hole for the plume in the brim and in this insert a short cork.

The feet on the base, which are made from the round ends of four clothespins, are glued in holes in the corners. Burn or write in India ink the inscription "Ye personal effects of Sir Walter Raleigh"; this

can go either on the beveled edge or on the top. If the brim of the hat shades the inscription, raise the hat on a small oval block about 3/4 in. thick. Stain and varnish the top and lacquer the edges black and feet red before mounting the boot and hat.

The saber is made of wood. The guard can be of sheet metal. I used an aluminum cookie mold from the ten-cent store.

Make the rocker-shaped blotter holder from wood and lacquer it black. On this is mounted the land-grant scroll, which is made from chamouis skin and glued to the block. Burn a suitable inscription on the

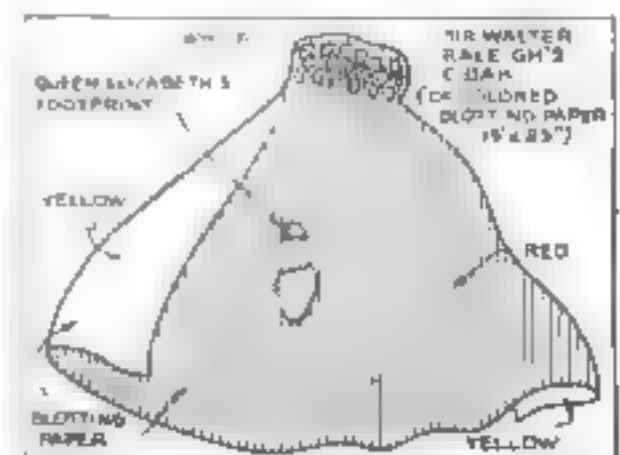


The boot and hat form the inkwell, and pencil holder stand, the saber is the letter opener, and the land grant covers the rocker blotter.

scroll and gave the skin a coat of shellac, or shellac it first and then do the writing with an indelible pencil. The blotter is held in place with thumb tacks.

The last item is the desk blotter which resembles the cloak. This is made by cutting pieces of colored blotting paper as shown and gluing or pasting them together. The Queen's footprint is then drawn on the cloak and colored with crayon.

For the tassels on the hat and saber I used the silk cords from bridge tally cards.



How the colored blotting paper is glued together to form Sir Walter's famous cloak.



# Folding Leather Coin Purse

*How to make a novel change pocketbook from a single piece of "tooling calfskin"*

By F. CLARKE HUGHES

**B**ECAUSE of the trick way in which it folds shut, a coin purse like that illustrated has a greater appeal for most men and boys than the more conventional types. It is practical, too, being easy to open and close, yet never falling open unexpectedly when in the pocket. Besides, it can be made highly ornamental with tooled or embossed designs.

In the accompanying sketches are given the layouts for both a six- and an eight-sided purse, and others with five or ten sides may be constructed just as easily. In the case of an eight-sided purse, an octagon is first drawn on paper with compass and rule. If this octagon is inscribed in a 3-in. circle, the purse will be a good size. The pattern is then completed as indicated, and the paper cut out and folded.

The leather should be what is known as "tooling calf." A piece 7 in. square or 7 in. in diameter will be large enough. Transfer the pattern to it and cut it out carefully.

The designs are the next consideration. That for the large flat area on the back of the purse may be traced on thin paper from the full size detail and transferred from the paper to the leather or to a piece of bathsheet linoleum depending upon whether the design is to be tooled with a blunt, round awl or embossed by means of a linoleum die as described in previous articles in this series (P. S. M., Nov. '29, p. 102; Dec. '29, p. 100; Jan. '30, p. 100; etc.). In either case, the design should stand out in bold relief against a stippled background. The stippling may be done with the point of a hollow nail set dot by dot, or with a stippling punch made by grooving the end of a nail.

The ornamentation on the ears or points of the purse

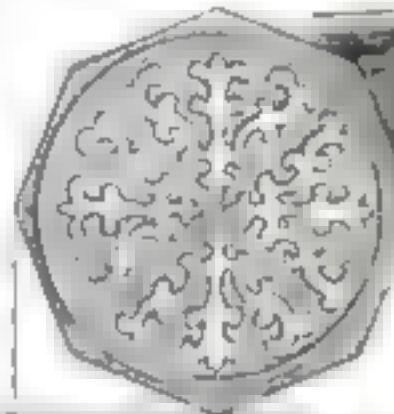
should correspond in style and execution with the main design on the back. A sample design is given full size in order that it may be traced directly.

If the leather is a little stiff or thick, the lines for folding may have to be thinned or grooved a trifle with the point of a knife. By dampening the purse slightly and leaving it overnight under a light weight, it will become well creased.

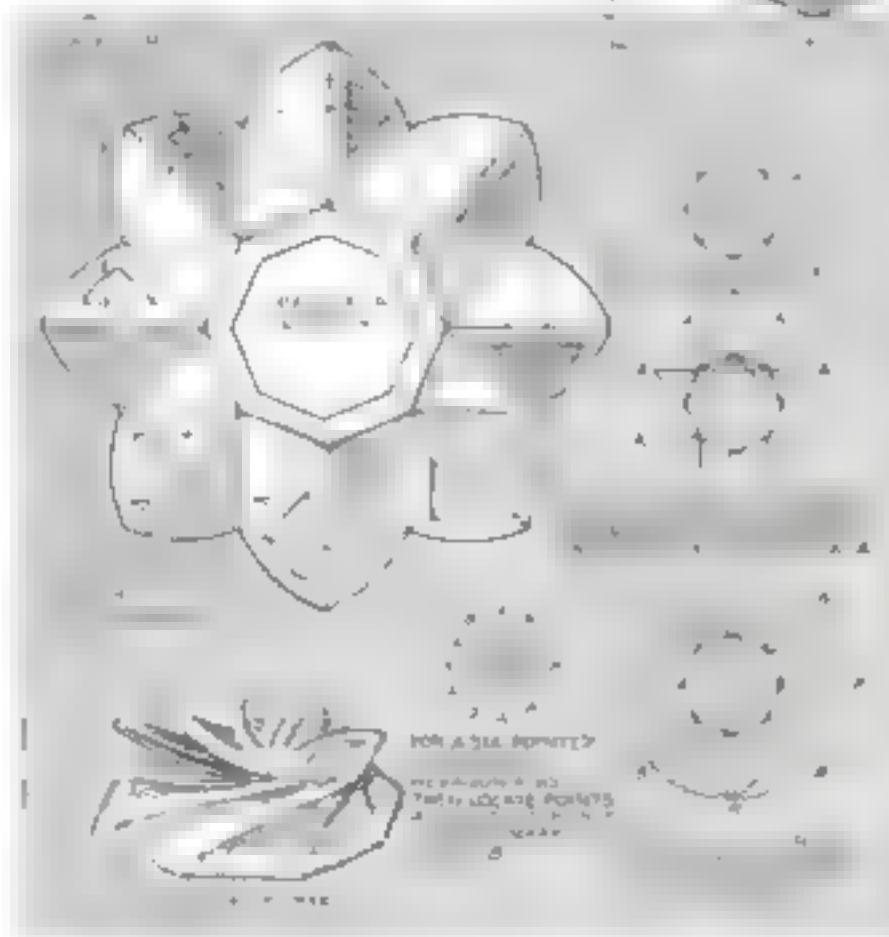
The leather may be left entirely in its natural color or the stippled background of the ornamented portions may be toned with some light color by the methods described in former articles. In either case the surface should be given a wax finish with either shoe dressing or floor wax. This will preserve the leather and bring out its natural beauty.



A practical purse for men. At left: Design suggestion for the back of the purse.



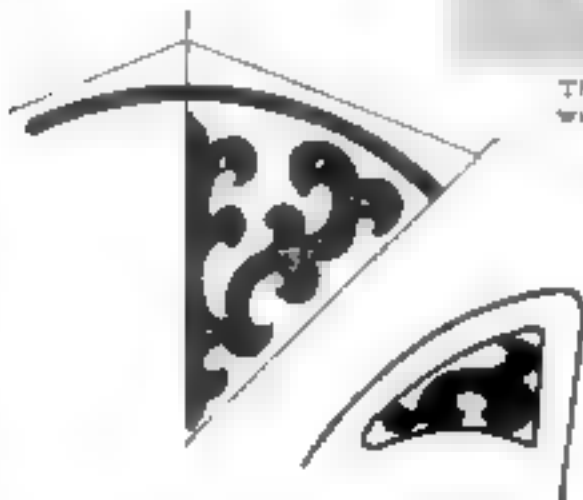
In order to insure against any error in cutting the leather, it is best to cut and fold a paper pattern first.



The steps in laying out a six- or an eight-pointed purse with a compass and straightedge. A completed purse.



If a design is to be embossed on the back of the coin purse, the die can be made by carving the pattern on the face of a piece of linoleum. Below: Putting the die in place.



A full size layout for the back and ears according to the design suggested above.

## Do You Play Golf?

Yes! Then it's about time to repair those pet golf sticks. If you are in doubt as to what to do and how to do it, don't fail to read an article on this subject by Alex Morrison, noted authority on golf technique, which is scheduled to appear in the April, 1931, issue.





"Fast and stable—results in rough water, very good," was the laconic way in which Mr. Jackson summed up a rigorous test of his new racer. He is a naval architect and for the past four years has specialized in the design of hydroplanes for many prominent outboard-motor racing drivers.

# Easily Built Outboard Racer

*A streamlined hydroplane of improved design which can be constructed by beginners at a surprisingly low cost*

By

WILLIAM JACKSON

**S**PEED, stability, strength, and simplicity of construction are the outstanding features of this outboard racing motorboat. It is a racer such as every outboard enthusiast wishes he owned whenever he sees a regatta and hears the full-throated roar of the boats as they tear across the starting line. So fast indeed, is this boat that it provides the thrill of an airplane without the hazards.

The streamlining of the hull gives the boat increased speed; at the same time, the sides are built at such an angle that

racing in Classes B and C, 150 lb. being the minimum in these classes. If a canvas deck is used instead of the wooden deck, the weight of the hull will be less than 150 lb., making the boat eligible for Class A only. Amateurs who are beginners race in Division 1, while those who have competed in fifteen or more heats or races must enter in Division 2.

The amateur with little or no boat building experience can construct this boat, but it will be necessary for him to study the plans and the bill of materials carefully

Two blueprints also have been prepared which will be found of great help; they contain drawings on a large scale and are much easier to follow than the necessarily small illustrations accompanying this article. To obtain them, send 50 cents for *POPULAR SCIENCE MONTHLY* Blueprints Nos. 128 and 129 (see page 117).

A small kit of woodworking tools is sufficient for the work, but as many of the pieces must be held temporarily in place with clamps, it is necessary to have about eight 6-in. C-clamps. As to materials, these can be obtained for approximately twenty-five dollars; at least, that is what they cost the writer.

The first thing to make is the form upon which the boat is built. The plans give complete details of this form, which can be sawn out of pine or any lumber available. It is a good idea to attach legs to this piece as it makes an excellent support for the hull (see photograph below).

Before constructing the frames, we must first draw each of them full size on heavy building paper. Fold the paper in the middle and draw half of the frame as shown on the plans. Go over the lines with a toothed wheel or use any other convenient method of transferring them to the other half.



Completed, the racer presents a hull-like appearance that is indicative of its performance.

the danger of capsizing is reduced. The racer has been thoroughly tested with a very powerful "pepped-up" motor to be certain that the construction would endure with the lower powered motor for which it is intended. It is designed for a "B" or "C" motor, although it may be used with a "D" motor.

With "B" and "C" motors a speed in the neighborhood of 40 miles an hour may be confidently expected, and with a "D" motor a speed well over 40 miles, provided conditions are exactly right. The author cannot guarantee this performance, but from the showing made by his own boat and from long experience in racing he feels that record speeds are within the reach of anyone who will take sufficient pains with the construction of the hull and will see that his motor is operating at its highest efficiency.

Complete with steering gear, the boat weighs 156 lb. This makes it eligible for



Laying out the parts for one of the frames by placing the stock over a full size pattern.

The construction of the hull is begun by clamping the keel pieces and frames in place on a wooden form (see drawing, page 92). Notice convenient method of supporting the form by providing it with legs.





then, when the paper is unfolded, you will have a pattern of the whole frame. To transfer this outline to the boards, mark the lines of the pattern on the wood with the toothed wheel.

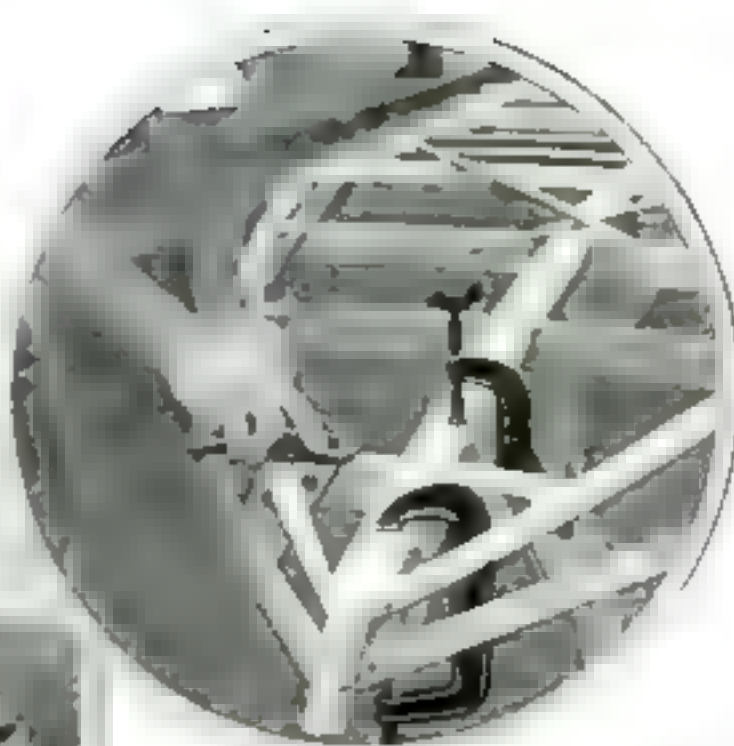
Cut out all bottom members first. Studying the plans, you will find that the bottom members of frames Nos. 8,  $7\frac{1}{2}$ , 7,  $6\frac{1}{2}$ , and 6 are alike.

To assemble the side members of each

the form temporarily. Lay a light batten along the side members and mark the bevels on the frames. When the frames are beveled, fasten the keel to each with two  $1\frac{1}{4}$ -in. No. 8 screws.

After the frames are secured

Before applying plank, smooth all projecting joints with a plane.

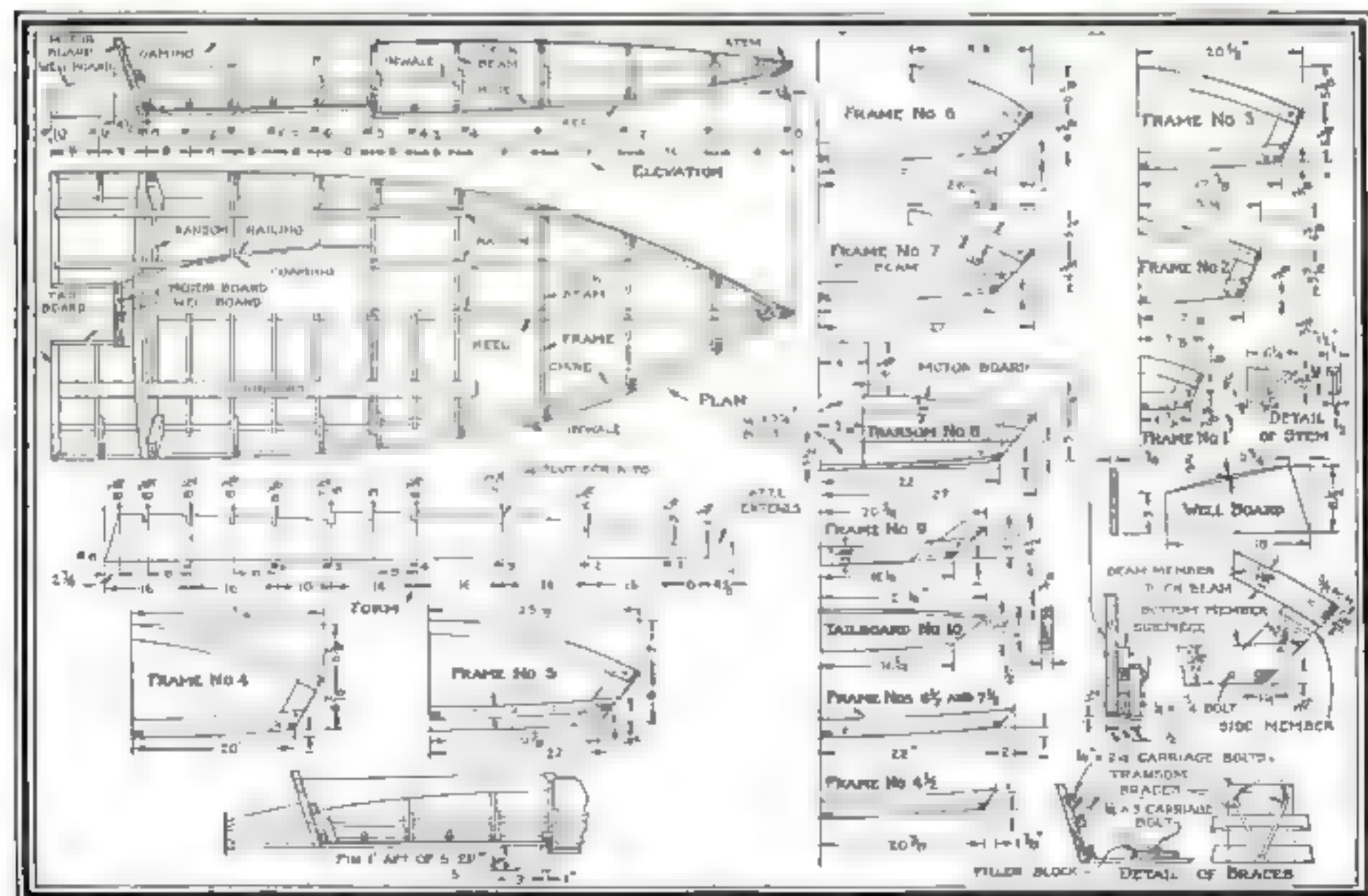


frame with the bottom members, lay the pieces on the paper pattern so as to conform to the outline and fasten them together with two  $\frac{1}{4}$  by  $1\frac{1}{4}$  in. carriage bolts.

When the transom and frames are assembled, lay them in their respective places on the form. Cut the keel pieces to the proper lengths and clamp them to

The author at work putting the chine piece in place along the side of the hull.

Rear view of the completed frame showing the tail board, well board, and motor board.



Assembly drawings of the completed frame and details of the form, keel, braces, frames, and motor board. The work of constructing this racer can be made easier through the use of the larger drawings included on Blueprints Nos. 128 and 129.

to the keel, tack strips from the floor to the transom and step so as to hold the frames level with each other. Also fasten strips to hold the step and the transom square. The stem is now fastened to the end of the keel with two  $1\frac{1}{4}$ -in. No. 8 screws.

Bevel the rear chines as shown in the drawings and fasten them to each frame with one  $1\frac{1}{4}$ -in. No. 8 screw. Fasten the forward chines without beveling, as these chines can be beveled after the framework is finished. Drive the screws which secure the chines first on one side, then on the other, because to fasten one whole side would pull the boat out of shape. Bevel the keel on the end and fasten the chines

to the keel with two  $1\frac{1}{4}$ -in. No. 8 screws.

We are now ready to attach the tail-board and well board. The side of the motor board is liberally coated with marine glue where the joint is to be made, and cloth is laid on the glued surface. Then each well board is fastened to the motor board with seven  $1\frac{1}{4}$ -in. No. 8 screws.

The tailboards are now fastened to the well boards. Glue the joints, lay the cloth on the glued surface, and fasten with five  $1\frac{1}{4}$ -in. No. 8 screws. Cut a notch for the chine halfway through the tailboard, and fasten the chine to the tailboard with one  $1\frac{1}{4}$ -in. No. 8 screw.

Cut a notch halfway into the tailboard for the sheer batten, sometimes referred

to as the inwale; and fasten the sheer batten to each of the frames and to the stem with one  $1\frac{1}{4}$ -in. No. 8 brass screw driven into each part.

The completed frame is now trimmed and faired.

*How to apply the side and bottom planks and either a canvas or a wooden deck will be told in the April issue.*

*If you encounter any problems in the construction of the boat thus far, Mr. Jackson will endeavor to answer your questions, provided you include a stamped, self-addressed envelope. Be as brief and definite as possible and address him in care of this magazine.*

## LIST OF MATERIALS

Form, 2 by 10 in. by 10 ft., any rough lumber  
Planking,  $5/16$  by 8 in., mahogany, white cedar, red cedar, pine, or cypress. For side planks, 2 pcs. 12 ft., bottom planks, 2 pcs. 12 ft., 2 pcs. 10 ft., and 2 pcs. 8 ft.  
Decking,  $3/4$  by 10 in., mahogany or cedar  
Cnaming, 2 pcs.  $3/4$  by 6 in. by 4 ft., mahogany or spruce  
Floor boards, 3 pcs.  $3/4$  by 3 in. by 4 ft., spruce or yellow pine  
Stringers, 2 pcs.  $3/4$  by 3 in. by  $6\frac{1}{2}$  ft., spruce or yellow pine  
Transom and tailboard, 1 pc.  $1\frac{1}{4}$  by 6

in. by 14 ft., mahogany or spruce  
Well boards, 1 pc. 10 in. by 3 ft., mahogany or spruce  
Motor board, 1 pc.  $1\frac{1}{2}$  by 12 by 16 in. mahogany or spruce  
Keel, 1 pc.  $3/4$  by 2 in. by 10 ft., mahogany or spruce  
Chines, 2 pcs.  $4\frac{1}{2}$  by  $1\frac{1}{2}$  in. by 5 ft. forward chines, 2 pcs.  $3/4$  by 1 in. by 7 ft., mahogany or spruce  
Battens, 4 pcs.  $1/2$  by  $1\frac{1}{2}$  in. by 10 ft., mahogany or spruce  
Sheer batten, 2 pcs.  $3/4$  by 1 in. by 12 ft., mahogany or spruce  
Deck batten, 3 pcs.  $1/2$  by  $1\frac{1}{2}$  in. by 10 ft. mahogany or spruce

Ribs, 1 pc.  $3/4$  by 12 in. by 12 ft., mahogany or spruce  
Deck beams, 1 pc.  $1/2$  by 12 in. by 8 ft., mahogany or spruce  
7 gross 1-in. No. 8 F. H. brass screws  
6 dozen  $1\frac{1}{2}$  in. No. 8 F. H. brass screws, 2 dozen  $1\frac{1}{2}$  in. No. 8 F. H. brass screws  
48— $3/4$  by  $1\frac{1}{2}$  in. carriage bolts; 12— $3/4$  by  $3\frac{1}{2}$  in. carriage bolts  
 $1\frac{1}{2}$  lb. 1-in. copper clinch nails,  $3/4$ -in. copper clinch nails  
1 quart "C" quality marine glue  
2 pcs.  $3/4$  in. by 2 ft. steel tubing  
1 tin about 5 by 9 in.  
Paint, varnish, strips of cloth, etc.

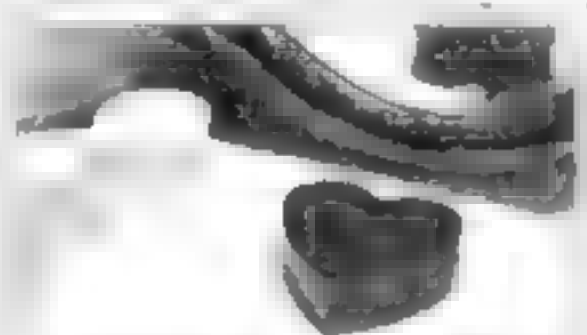
## Heart-Shaped Box for Trinkets

IF YOU like to do work that is out of the ordinary, you will enjoy making the heart-shaped trinket box illustrated. Besides being an attractive and interesting project, it is inexpensive, since scrap pieces of mahogany, walnut, or other hardwood serves as the stock.

The body of the box is glued up from  $1\frac{1}{2}$ -in. blocks of wood and cut to shape on the band saw. In cutting the blocks, care should be exercised to keep them

square; this will save time when gluing them together.

When the blocks are finished to size, put them in position as shown in the drawing and clamp them tightly together. Then use a paper pattern to mark the shape, both inside and out. This done, take off the clamp or hand screw and glue the blocks together, the four top layers in one sec-



Clamped, the trinket box gives the appearance of having been shaped from a single block.

tion and the bottom three in another. While waiting for the glue to dry, cut the top and bottom pieces to shape. In the writer's box these were cut from one piece so that they both had a knot in the center giving the finished box the appearance of being carved from a solid block of wood.

When the glue dries, the two sections are ready to be hand-sawed to shape. Then the sections are glued together and, after the glue dries, are smoothed to the line with plane, rasp, and sandpaper. At this point finish the inside.

Next, glue the top and bottom in place

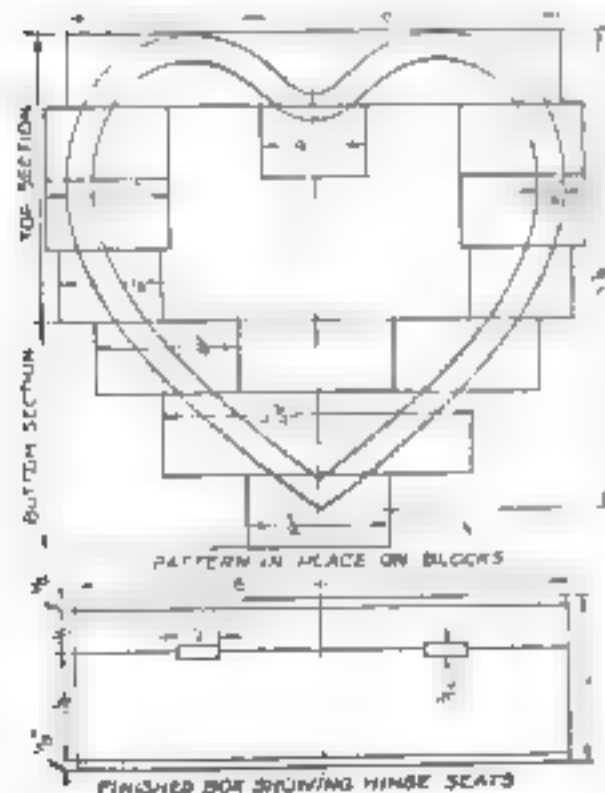


On the dresser, the box forms an appropriate decorative display for jewelry and keepsakes.

with the grain running in the same direction as the heart points. Smooth off the edges and draw a line  $11/16$  in. from the top all around. Using a hack saw and following this line, cut clear through to separate the top from the bottom.

In placing the hinges, fasten them to the bottom half first, each with one screw, and then fasten one hinge in place on the top with a single screw. Test the box to see that it closes and then drive the remaining screws.

The box illustrated was French polished, although three coats of shellac well sanded and then a finishing polish with wax will serve.—L. M. CURTIS, JR.



How the blocks are glued together to form the sides of the box. Rear view of the box.





## THE CHEVROLET SIX ENGINE

**has many features of design  
unusual in a low-priced car**



If you are interested in the mechanical side of motor cars—lift the hood of the new Chevrolet. You will find a number of very interesting features in the engine of this car—many

points unusual for a car so low in price.

To begin with, Chevrolet pioneered the Six among cars of the low-price field—and today's motor brings out the full possibilities of this principle. It develops 50 horsepower at about 2600 r. p. m. and combines this power with marked smoothness, quietness and economy of operation.

Further contributions to smooth performance are made by the Chevrolet crankshaft, and the construction of the cylinder block. The crankshaft is unusually heavy, weighing 48 pounds. A simple but effective harmonic balancer adds to the efficiency of its operation. And the cylinder block is made stronger by the use of strong ribbing reinforcements. In fact, so efficient is this new construction

that a 40 per cent increase in rigidity has been obtained with only a 1½ per cent increase in weight.

The Chevrolet motor reveals many important advancements that have a direct bearing on other phases of the car's performance. An accelerating pump provides extra power when needed. A hot spot manifold assists in quick starting. A combination air cleaner and flame arrester cleans all air that goes to the cylinder walls and protects against engine back-fire. A crankcase ventilator removes gas fumes from the crankcase. A steel ring has been added to the fly-wheel to provide longer life and smooth, easy engagement of the starting motor. The special design of the Chevrolet combustion chamber permits high compression with ordinary fuels, and results in unusually high gasoline mileage.

Every man who knows engineering will appreciate the quality and advancement represented by this new Chevrolet power plant. It sets a new engineering standard for cars in the low-price field.

*Chevrolet prices range from \$475 to \$650, f. o. b. Flint, Mich., Special equipment extra  
Chevrolet Motor Company, Detroit, Michigan, Division of General Motors Corporation*

## NEW CHEVROLET SIX

***The Great American Value***

With this inexpensive photographic outfit you can

# Make Your Own Enlargements

EVERY camera owner has wished at times for enlargements of some of his pictures. Enlargements made commercially are, of course, expensive, and enlarging cameras are almost prohibitive in price, but an enlarger that will produce perfect pictures can be made with no other materials than a small amount of pine or other soft lumber, two 100-watt lamps, a pair of  $\frac{3}{8}$ -in. wing nuts and bolts, and the camera with which the pictures are taken.

The outfit shown here is designed to make pictures 11 by 14 in. and delivers its light by indirect illumination. First make the lamp box of  $\frac{3}{8}$ -in. stock and cut a central hole  $\frac{3}{4}$  in. larger all around than the film size of the camera; that is for a  $2\frac{1}{4}$  by  $3\frac{1}{4}$  in. film cut a  $2\frac{1}{4}$  by  $3\frac{1}{4}$  in. hole. Cut holes for the lamp sockets and hold the sockets in place with cleats as shown. Leave the top uncovered until the last, and give the inside three coats of flat white paint.

A sheet of glass of convenient size is placed over the film opening on the inside; its function is to maintain a dead air space between the inside of the box and the film to prevent overheating.

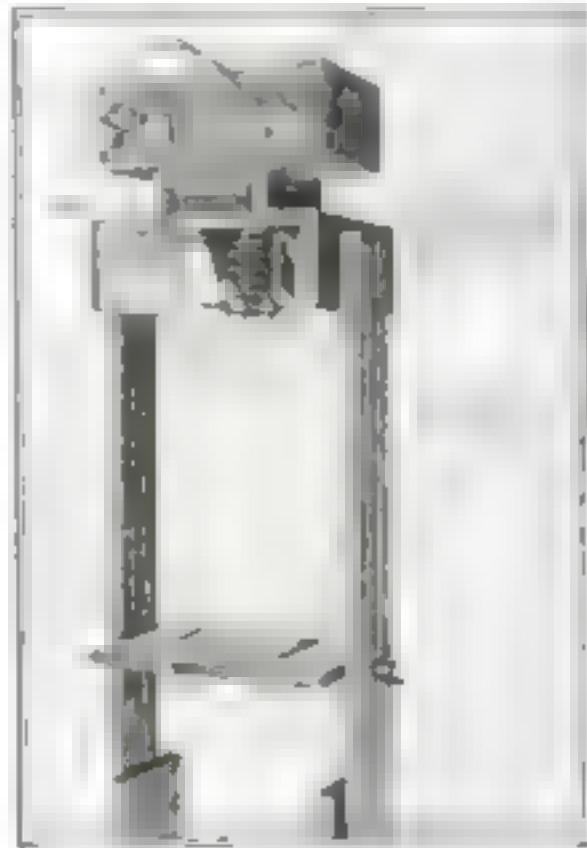
Next make the film-holding frame of  $\frac{3}{4}$ -in. stock  $1\frac{1}{2}$  in. wide; this should have an opening  $2\frac{1}{4}$  by  $3\frac{1}{4}$  in., or whatever the size of the film is. Two small rabbeted cleats are prepared and glued and bradded to the outside as shown so that two sheets of glass with the film between may be slid into position over the opening. A strip of wood or cardboard is glued against one end of the cleats to prevent

By

FARETT KAMPS

the film and glass from sliding through. The completed frame is then held snugly against the opening in the box with four screws.

The support for the camera and light box is what amounts to a box with one side and the bottom open and with a rectangular hole in the top through which the camera bellows can pass. On the upper side of this box is mounted a three-sided support for the



The enlarging machine ready for use with the paper and mat in place on the movable board.



Photography is much more fun if you have facilities for making your enlargements.

light box with a strip of sheet iron or brass arranged as shown in the drawings to center the light box over the camera. Note particularly that the film frame is set directly over this support and both must have the same outside dimensions.

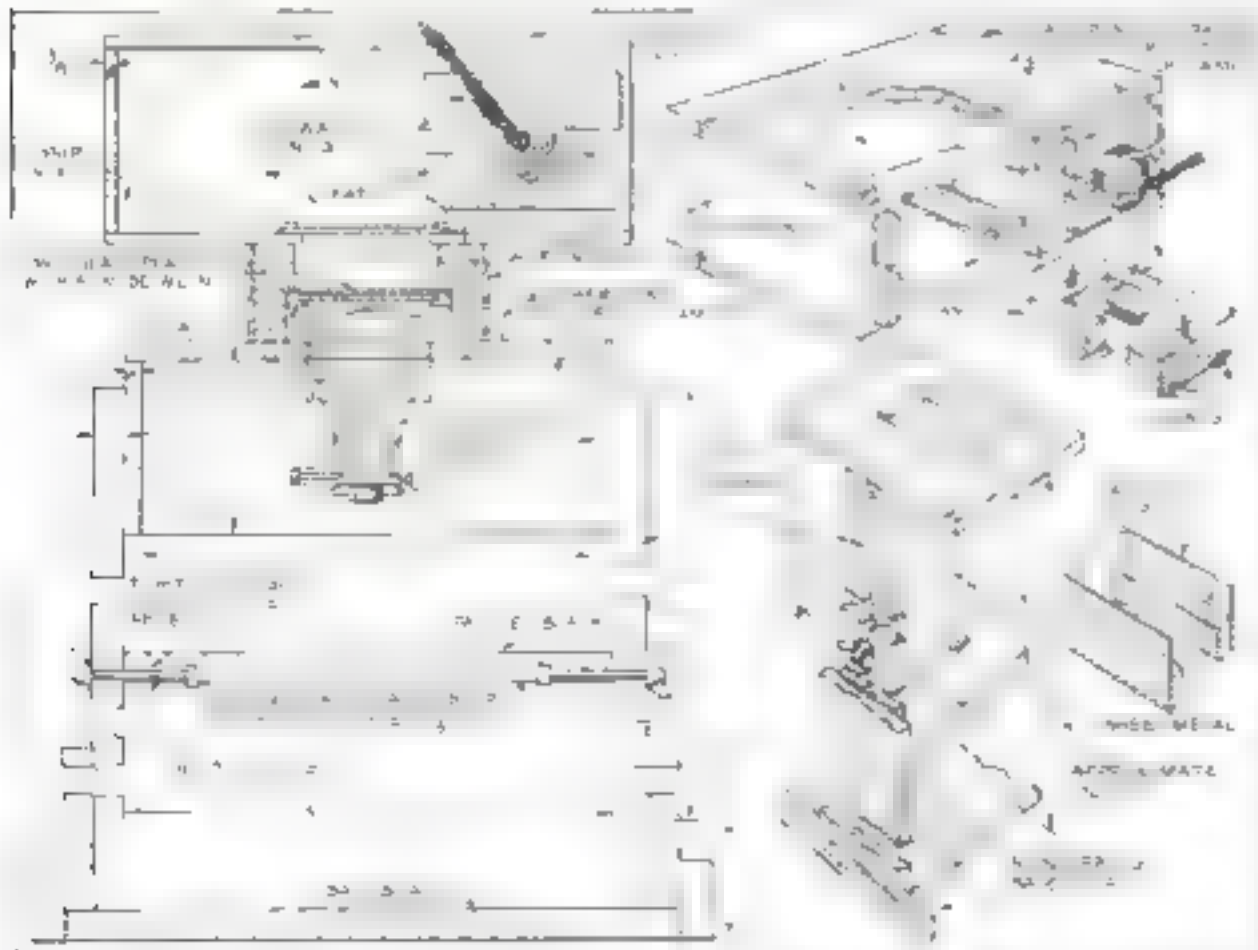
To the sides of the camera-holding box or platform are screwed 2 by  $\frac{3}{4}$  in. by 3 ft. strips. There are two of these on each side set  $7/16$  in. apart. These pieces, in turn, are attached to two boards that reach to the base, as indicated in the drawings.

The sliding board for holding the paper is made of  $\frac{3}{8}$ -in. stock and varnished to prevent warping. Recesses are chiseled in the underside to receive the heads of the bolts, which are then secured by brads driven into the board and bent over.

The entire outfit should be painted a flat black, and the two lamp sockets connected to a single cord and plug. A supply of cardboard mats of various sizes should be prepared, and a stock of bromide paper laid in.

To operate, remove the back of the camera and set it in the position shown in the photograph. Place the film between the two sheets of glass and insert it in the film frame face down. Then turn on the lights and focus by raising or lowering the board. Make the fine adjustment for sharp focus by racking the camera bellows up or down as required.

To make 11 by 14 in. enlargements, lay another board about 13 by 16 in. across the sliding board. In printing large pictures, it should be remembered that the amount of light used is constant. When it is spread over an 11 by 14 in. surface, the time required to print will be much longer than if a 5 by 7 in. print is being made.



The front view of the enlarging outfit broken away in three places to save space, and sketches showing the construction of the lamp box, film-holding frame, camera support and main frame.



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# Resilvering Mirrors at Home

*The process is neither difficult nor expensive if you use the correct formula and exercise a moderate amount of care*

By

D. C. MARSHALL.

*Illustrations by  
M. J. H. A. 1915*



If interrupted after cleaning the glass, lay it in the tray and cover it temporarily with distilled water

**R**ESILVERING a mirror can be done by any home worker who uses reasonable care and sees that absolute cleanliness prevails in every stage of the process. The equipment needed is limited in both cost and amount, and no part of the operation requires exceptional skill.

The first step is the preparation of the solutions. Since the principal chemicals must be weighed accurately in grains, I shall list exactly what is needed so that the purchaser can have them weighed at the drug store or chemical supply house where they are bought. All must be pure and of the highest grade—that is, designated as c. p. (chemically pure). The list is as follows:

Nitrate of silver	306 grains
Nitrate of silver	250 grains
Rochelle salts	96 grains
Nitrate of silver	96 grains
Rochelle salts	144 grains
Nitrate of silver	96 grains
Strongest ammonia	1 ounce
Nitric acid	4 ounces
Distilled water	4 gallons

In preparing the solutions, place the 306 grains of silver nitrate in a glass or graduate and dissolve it in about 3 ounces of distilled water. To this solution add the strong ammonia drop by drop and watch

the reaction. The solution will become muddy and then it will gradually clear and the ammonia must be added until it is just clear. The next step is to dissolve 250 grains of silver nitrate in 16 ounces of distilled water. When it is completely dissolved, the two solutions are poured into a gallon bottle, and enough distilled water is added to make one gallon of solution. This bottle is labeled "Solution No. 1."

Solution No. 2 is now prepared. One half gallon of distilled water is placed in a porcelain lined vessel and 96 grains of Rochelle salts are dissolved in this. It is then allowed to boil vigorously for one minute, after which 96 grains of nitrate of silver are added, this amount having been previously dissolved in 3 ounces of distilled water. The combined solution is then boiled ten minutes, cooled, and filtered into a half-gallon bottle, and the bottle is filled up with distilled water to make a full half gallon.

Solution No. 3 is prepared in exactly the same way as No. 2 except that the quantity of Rochelle salts used is 144 grains, with 96 grains of silver nitrate. These solutions must not be allowed to touch your hands; indeed it is a good idea to wear rubber gloves. If by accident you do stain your hands with the silver nitrate the marks can be removed with hot hyposulphite of soda (hypo) provided the cleansing is done immediately.

The second step is the preparation of the tray for holding the mirror. Place a piece of oilcloth on a flat table top and lay the mirror on the oilcloth so that there will be an edge protruding on all sides. Place strips of wood under the oilcloth around the edge of the mirror so as to form a tray to hold the silvering solution.

The preparation of the glass is the third step in the process. Mirrors are of two kinds: the older type which is not painted on the back and the modern type which has a coat of paint over the silver to protect it. If the mirror is of the first kind, the silvering may be dissolved

with nitric acid applied on a swab made by winding absorbent cotton on the end of a glass rod. If it is the second type, the paint must be removed with varnish remover and then the silver dissolved with acid. Do not scratch the glass, for the slightest defect will be visible when the mirror is finished. The acid is washed off, and the glass is again washed with soda to remove any traces of grease that may be present. After this washing, the side to be silvered must not be touched with the fingers, as the oil of the skin will adhere to the glass and cause a spot in the silver. The glass now should be rinsed several times with clean water and finally with distilled water and it should not be allowed to become dry. If you are interrupted, lay the mirror in the tray and cover it temporarily with distilled water.

To silver the mirror take equal parts of solutions Nos. 1 and 2 and mix enough so that there will be 4 ounces for each square foot of glass. As soon as they are mixed, pour the solution on the glass in the tray. Do not delay, for the silver starts to precipitate out immediately. After the mixed solution has been on the glass for about thirty minutes, drain it off and wash away the sediment with running water. Then cover the glass with a solution composed of equal parts of Nos. 1 and 3 and allow it to remain for a like period. At the end of this time the glass is removed from the tray and washed with running water after which it is set up to dry. When the silver is dry, it is ready for painting.

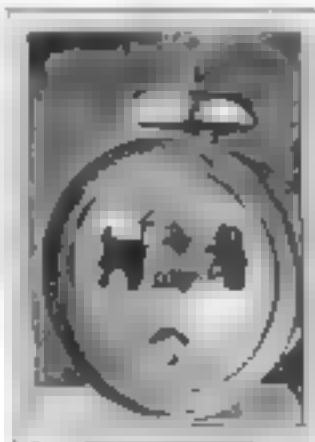
To prepare the paint, take 1 pint turpentine asphaltum, 2 ounces damar varnish, 2 ounces white lead, and 1½ ounces of turpentine. Dissolve the lead in the turpentine and after adding the other materials stir until all are thoroughly mixed. Apply with a soft hair brush.

## AN ALARM CLOCK THAT SHUTS ITSELF OFF

**T**HOSE who invariably awake at the first ring of an alarm clock and dislike having to fumble in the dark to turn it off can make the clock self-stopping in a very simple manner. This is done by taking advantage of the fact that any ordinary alarm clock will stop ringing if the alarm setting hand is turned forward a distance representing about half an hour on the dial.

Having made this discovery, I soldered a strip of tin to the alarm setting handle in such a way that when the alarm goes off and the alarm-spring winding key starts to unwind, the latter will strike the tin and push it around far enough to move the alarm setting hand the distance necessary to shut off the alarm. To make the action positive and insure that the alarm winding key would not unscrew from its arbor, I soldered it, too, securely in place.

This device stops the bell in about ten seconds.—H. MOORE

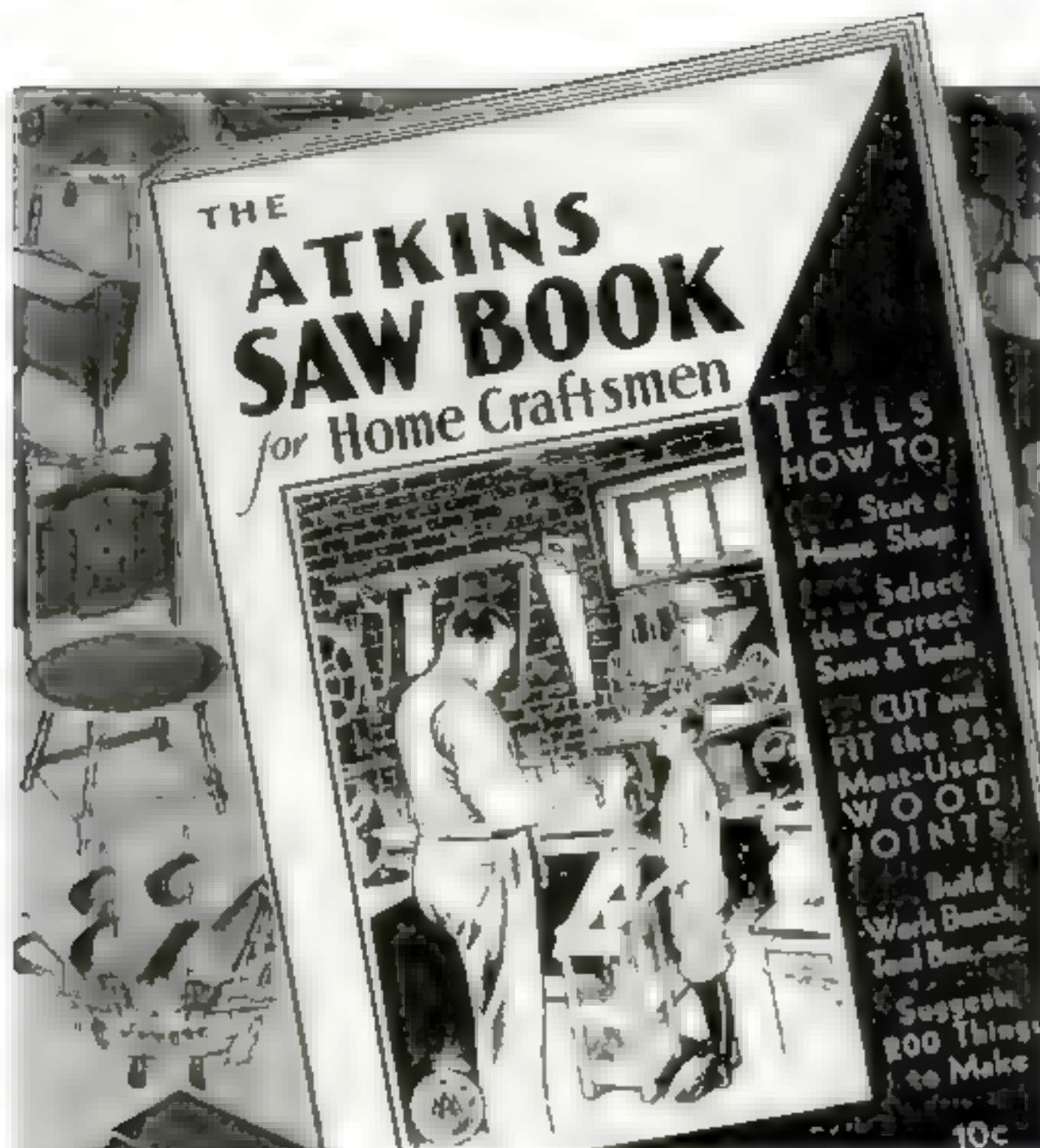


Rear view of clock showing tin strip.



The prepared solutions can be kept in stoppered one-gallon bottles. Notice the oilcloth tray in foreground.





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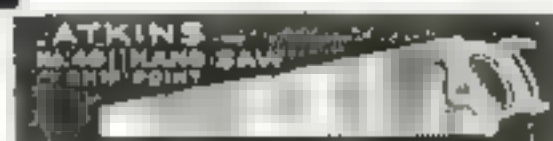
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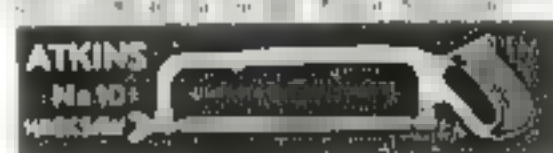
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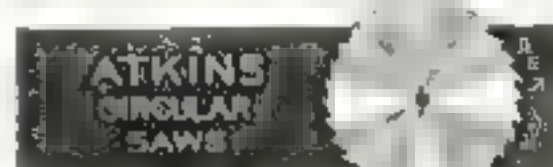
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# New Ideas for Car Mechanics

## Brake Indicator Light Burns Only When Engine Runs—Easy Way to Wash Neglected Body Top

POPULAR SCIENCE MONTHLY awards each month a prize of \$10, in addition to regular space rates, for the best idea sent in for motorists. This month's prize goes to Archie Amos, Fort Wayne, Ind. (Figure 3). Contributions are requested from all auto mechanics.



**H**ERE is an emergency brake indicator light with a novel feature. The ordinary method of hooking up such a light has one serious defect. If you forget to turn off the light when you leave the car the light may run down your battery. By taking the current supply from the generator instead of from the battery wiring the light will burn only while the motor is running and the emergency brake is set. The wiring is shown in Fig. 3. A jeweled radio indicator light or any other small light fastened to the dashboard of the car will serve the purpose.

Locate the wire that comes from the generator and connects to the automatic cut-out. Make connection to this wire as shown. Since the voltage on the generator side of the line may rise above six volts, use a twelve-volt bulb or a fixed resistance in series with the six-volt one.

Fig. 3 shows hose attached to long handled scrubbing brush and used for convenient cleaning of car top.

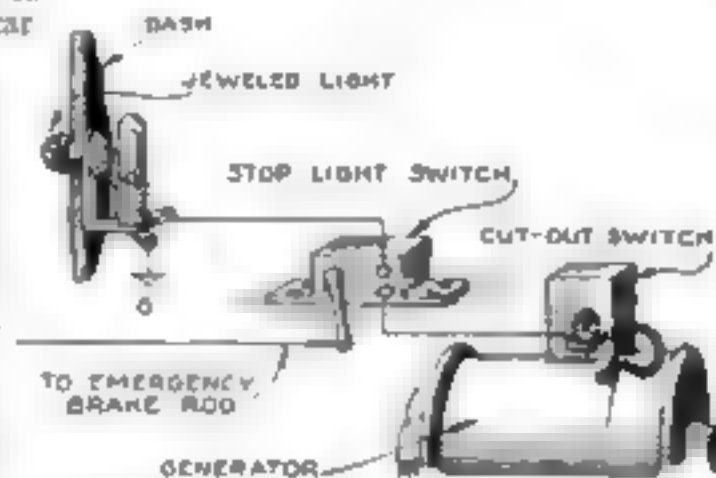


Fig. 3 Emergency brake indicator light, hooked to the generator, is on only when engine runs.

### WASHING AUTO TOPS

AUTO owners who take care of their own cars often neglect to clean the top. A simple solution of this problem is shown in Fig. 2. Take a wall brush and attach to the handle a short length of garden hose, binding it at several points with tire tape. Place a hose union at the handle and have the brush end of the hose a few inches from the head of the brush. No nozzle is necessary. When you want to clean the top, fasten the brush to the end of the garden hose and turn on the water. A few sweeps of the brush and the job is easily and quickly done.

### CLOTH HOLDS SCREW

MANY useful ideas for holding screws so as to start them in hard-to-get-at places have appeared in POPULAR SCIENCE MONTHLY. Figure 4 shows one of the most ingenious tricks that we have described. First take an old rag, one that tears easily is best, and push the point of the screw through the cloth near the center. Next place the screw driver blade in the slot of the screw head and pull the cloth back over the blade with a twisting motion. The pull of the cloth will hold the screw in place on the end of the blade until you get it started in the thread. After it has taken hold, pull the cloth over the head of the screw.

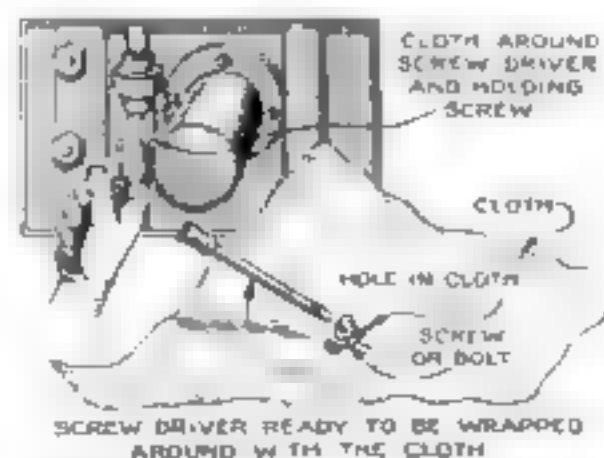


Fig. 4. Screw pushed through a cloth can be held securely and threaded into hard places.

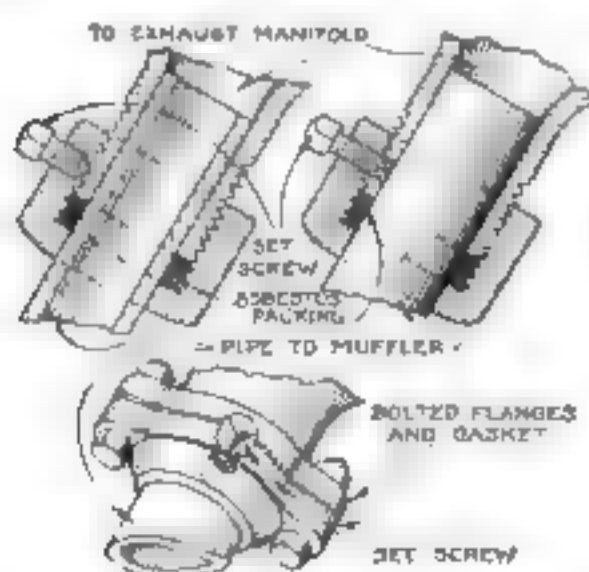


Fig. 1 Set screw in exhaust pipe manifold holds it tight and stops escape of gas.

### EXHAUST UNION CLAMP

ON MANY engines the union that holds the exhaust pipe to the exhaust manifold has a tendency to come loose. And when it does, the leaking gas makes an objectionable noise. Figure 1 shows a way to overcome the trouble. First screw the union as tight as you can get it. Then drill a hole through the shell and tap it for a set screw. Better still, run the set screw through the wall of the exhaust pipe.

### SUITCASE CARRIER

IF YOUR car is fitted with the mudguard bumpers now so popular, you can fit a carrier for a single suitcase or similar package as shown in Fig. 5. Most of these bumpers are of the double bar type and there is plenty of space for a board or

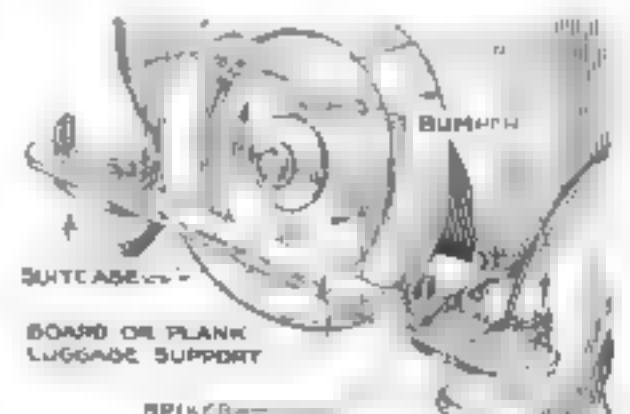


Fig. 5 Bumpers will carry board to which suitcase can be strapped when on a trip.

plank between the two bars as indicated. Temporarily, the board can be held in place with heavy nails driven in forward of the bumper bars. The top of the suitcase can be lashed to the spare tire.

While this luggage carrier does not look as well as a commercial one, it will serve in an emergency.



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*Introducing Frank Bradley, expert craftsman, who shows a friend*

# How to Make Mitered Joints

It's too bad you can't visit Frank Bradley yourself. You'd enjoy it—and he would, too, because there is nothing he likes better than talking of home workshop matters in his basement shop. You'll appreciate his skill after reading this article and several others to follow.



"Please saw this board in half lengthwise," said Frank, "and joint both edges of each piece."

*By* DONALD G. SAUNDERS

**F**RANK BRADLEY was working at his bench when the door of his home workshop opened and in walked Russell, his next-door neighbor.

"Frank, I'm up against it with another little problem," said Russell after the usual greeting. "Will you help me out?"

"Surely, if I can," responded Frank cheerfully as he adjusted several boards he was gluing up. "but you'll have to wait just a minute until I get these clamps set."

Waiting was no hardship for Russell or any other home workshop fan who had occasion to come to Frank's shop, for it was the envy of all the craftsmen in the neighborhood. Each hand tool had its place, and every machine was mounted with a thought for operating efficiency. The home workshop hobby, indeed, was a tradition in the Bradley family; even Frank's two young hopefuls, Doris and Jimmy, had their bench and tools and at this very moment were building a doll's house for a younger cousin.

"All set," exclaimed Frank, as he placed the gluepot back on the heater. "What seems to be the trouble?"

"Well," began Russell, "every time Mildred saw your wife raise or lower a window last summer without having to bother with adjustable inside screens, her soul was filled with envy, so I ordered the stock for making outside screens like yours, and it came today. The whole construction,

so far as I can see, is just one miter joint after another. And I never made a miter joint in my life."

"A miter joint is easy enough to make if you start right."

"But won't I need an iron miter box? I don't feel like spending twenty dollars for a tool that I may not use more than two or three times a year."

"I'll lend you mine."

"No, no," interrupted Russell hastily. "That isn't what I meant at all. I was wondering about the wooden miter boxes such as the old-timers used."

"They turned the trick all right," said Frank as he sharpened a pencil with a chisel, "and one would serve your purpose very well."

"Then how shall I go about making one?"

"Let me show you. It will take only a few minutes."

Frank went to a corner in which were piled scraps of stock and selected a piece of pine about  $1\frac{1}{4}$  by  $2\frac{3}{4}$  in.—a dressed "two by three"—and a board  $\frac{1}{2}$  in. thick and about 9 in. wide, both pieces being about 3 ft. long.

"Please saw this board in half lengthwise and joint both edges of each piece on the machines," Frank said. "They will make the sidepieces. Meanwhile I'll joint the bottom piece by hand."

Both men went heartily to work and by

the time the "zing" of the circular saw and the whirr of the jointer ceased, Frank had finished planing the bottom. Then Frank took the two sidepieces from Russell and proceeded to nail them in place along the edges of the bottom piece.

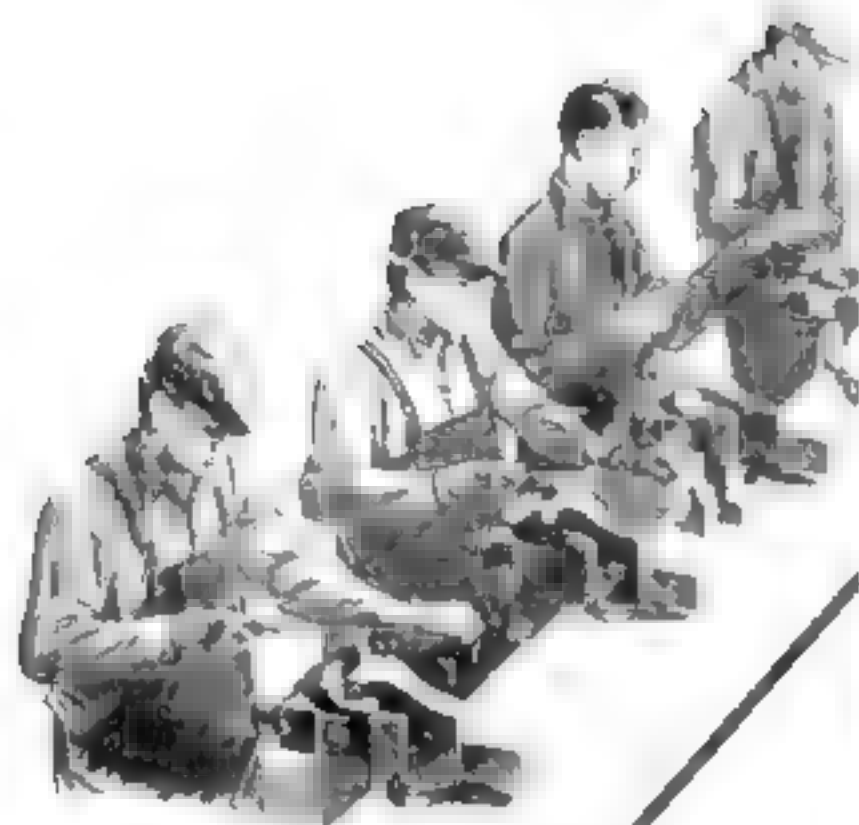
"I had guessed that far," said Russell. "My chief perplexity was how to lay out the cuts so that they would be exactly at forty-five degrees to the center line of the box."

"Here's where your geometry will come in handy," laughed Frank as he took a steel framing square from its rack. "Let's place identical figures on each edge of the square, say eight, so that they coincide with the inside top edge of the backpiece—and keep the square about in the middle of the box. This gives us the angles, and all we have to do is to make two pencil marks across the top edge of each sidepiece. Then we place the square on its edge in the box and mark from these lines to the bottom. We must make similar marks on the outside, too. What's hard about that?"

"Nothing," admitted Russell. "I should have figured it out myself. I guess most folks forget their geometry if they don't use it."

"The next thing," Frank went on, "is to make the cuts very accurately. It is best to use the saw which is to be used with the miter box, but I have just filed my



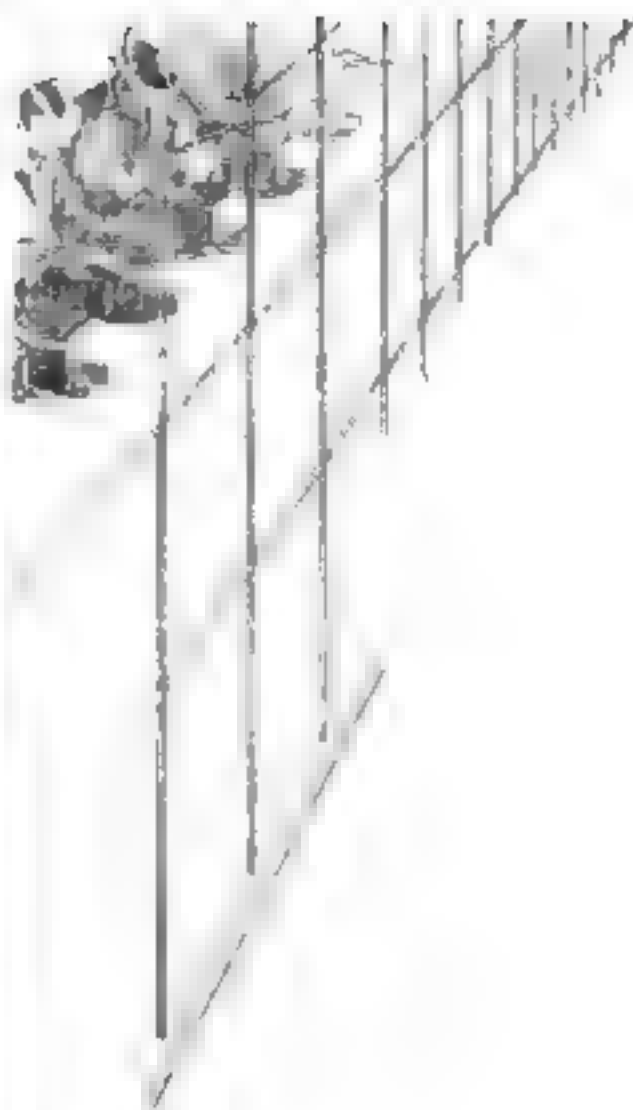


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panel saw, so we can make the cuts with that."

Frank made the first cut with the utmost care.

"Bear in mind," he warned, "that you must never use anything but a sharp, smooth-cutting saw in a wooden miter box. Never force it. Let it run lightly or it may follow the grain of the wood and the cuts in the box will soon be destroyed."

"Why make the box so long?"

"Because when one cut becomes worn, others can be made as they are needed."

I see. Well, now I have this miter box the rest will be easy sailing—or will it?" he added hastily as he noticed Frank's quick look of amusement.

"You may be in for a surprise party when you nail your first miter joint."

"I'm not just driving nails, then."

Instead of replying, Frank walked over to the scrap corner and selected a piece about the size of the screen stock. From this he cut four pieces in the new miter box, each with one mitered end.

"Now I want you to nail a miter joint together," he said, as he hung the saw on its peg.

"Here is the vise, the hammer, and also some sixpenny finishing nails."

Russell rather awkwardly placed one piece upright in the vise with the mitered end several inches above the bench top and made several attempts to drive the nails. Neither the nails nor the wood seemed to behave themselves.

"Not so good," Russell confessed.

"There must be a better way of doing it or the joint would not be used so commonly."

"There is," Frank assured him, as he picked up the other two mitered pieces.

First make one hole with a bradawl in the middle of one edge about three quarters of an inch from the end, and make two holes in the other piece. Notice that the single hole should go in straight while the two holes in the other piece slant in towards the center slightly to give the

nails such a direction that they will not drive out of the side of the piece in the vise."

"I can see the need of that now," admitted Wilk.

Frank placed the piece with the single hole in it in the vise with the joint about level and quite close to the jaws to prevent any vibration. Then he entered two nails in the awl holes of the other piece and placed the mitered end on the piece in the vise.

Picking up the hammer, he pointed out



Frank trued up the bottom piece by hand with his jointer plane and checked its squareness.



Marking the vertical cuts with the square standing on its edge.



"Not so good," confessed Russell after he tried to nail the mitered joint in this manner, which is far from being the right way.

Russell had been watching carefully. "After all," was his comment, "the joint is about as simple as it looks when you go at it in the right way. After one or two attempts, I shall have no trouble."

"Be sure to nail the joints in proper sequence," Frank said. "Two diagonally opposite joints should be nailed first—one side and one end, each pair making an L. Place the one-hole piece of one L in the vise and drive the nails as in the single joint. You will have to be careful in handling the frame, or the joints already nailed will be racked. If that happens, usually setting the nails again will remedy it."

"I understand," said Russell. "Now, how is the middle cross-piece on the screen put in?"

"That should be squared off to the same length as the inside of the screen frame. Usually it is placed one inch above the center to cover the meeting rail of the upper sash and is fastened with tenpenny finishing



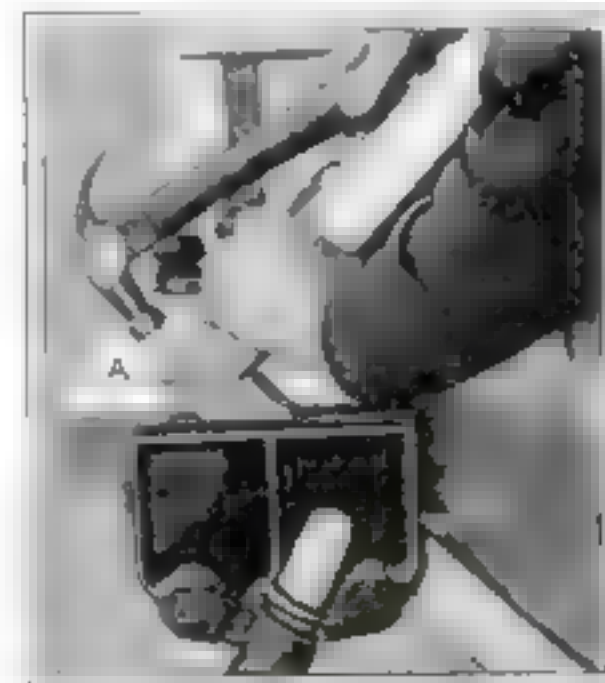
The square was placed so that the 8-in. mark coincided with the inside top edge of the back.

nails driven carefully through the sides."

"I am certainly grateful," said Russell. "What I have learned tonight will hold me until I get to stretching the wire screening."

"Then come in again and I'll show you what little tricks I've found out about it," Frank promised as they said good-by.

Another story about Frank Bradley and his home workshop will be published in an early issue.



Note how the upper piece is advanced beyond the lower piece about  $\frac{1}{4}$  in., as shown at A.



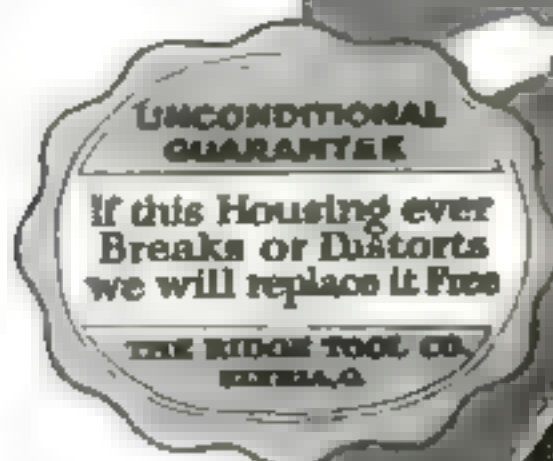
It takes experience even to make the holes for starting the nails in a workmanlike way.

that the outer edge of the upper piece was set so that it extended  $\frac{1}{4}$  in. beyond the piece in the vise (as shown at the right).

"This is the real trick in nailing a miter joint of this sort," he continued. "The upper piece must be held firmly with its faces flush with those of the piece below. Drive one nail to draw the upper piece along the lower until both edges almost coincide. Drive the second nail nearly home, then drive both until the edges meet perfectly. Turn the joint around, placing the two-hole piece in the vise, and drive the single nail. When this is done, set all of the nails."



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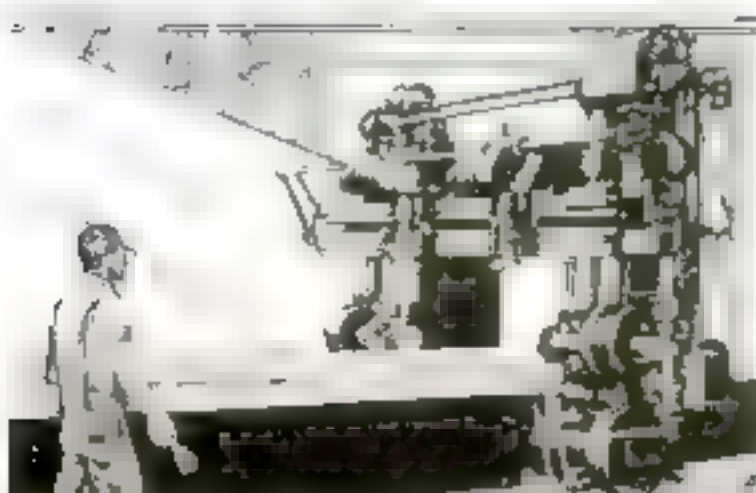
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# Hints on Blanking Sheet Metal



**BETTER SHOP METHODS**

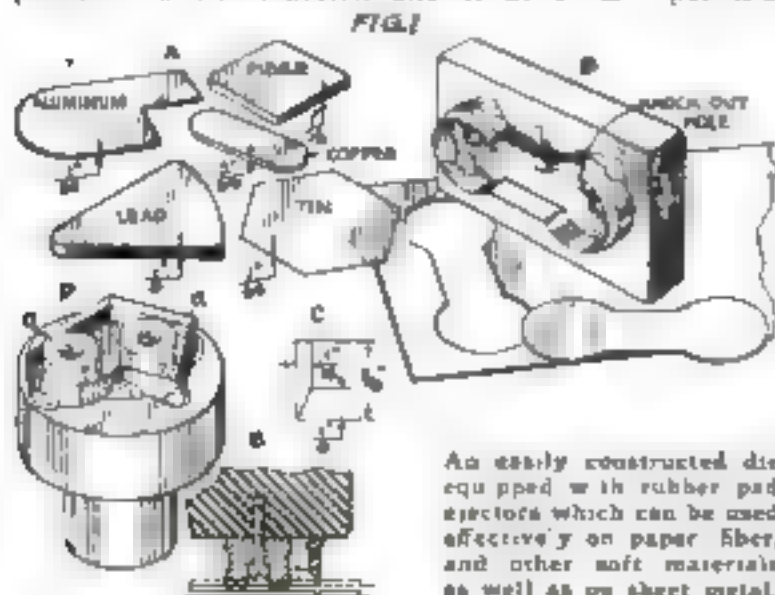
*How to save handwork and dodge die expense when making duplicate parts*

By HENRY SIMON

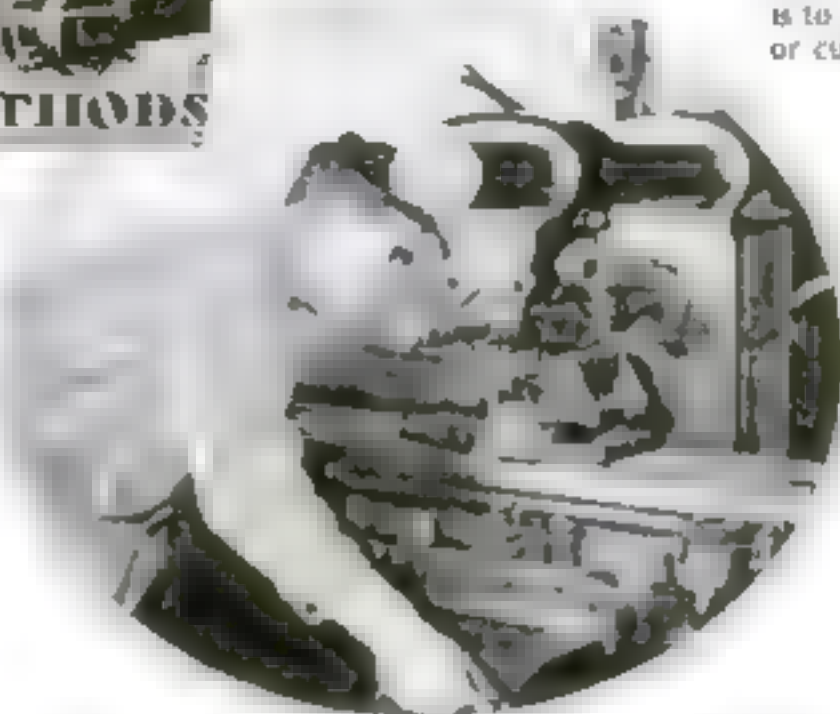
**W**HILE a regular die is undoubtedly the best means of producing a shape in sheet metal, it is very costly if only a small number of parts—say anywhere from a few dozen to several hundred pieces—are to be made. Such small lots, indeed, often present difficult problems, for they are apt to be excessively costly whichever way they are made—too expensive as to time if made by hand, and too expensive as to tools if made under the press. There are, however, ways to sidestep any trouble by the judicious use of several methods which we shall discuss in this article.

If the parts do not have to be extremely accurate as to shape and if the stock being used is fairly soft and moderately thick like those in the group of parts shown at A in Fig. 1, it is often possible to make a good cutting tool out of "shoe-die" steel. An example of such a die is shown at B. Shoe-die steel is a strip tool steel which has been supplied with a sharp knife-like edge similar to that shown at C. It is supplied by several makers in various forms. For our purposes, a good substitute can easily be made by grinding and filing a strip of ribbon tool steel or "ground flat stock" to the required shape.

A convenient way to mount such a die is to solder it to the flat face of an ordinary punch holder as at D, supplying it with one or more ejectors made from rubber pads. The construction shown at B is



An easily constructed die equipped with rubber pad ejectors which can be used effectively on paper, fiber, and other soft materials as well as on sheet metal.



In cases where only a few simple duplicate sheet metal parts are required, they can often be brought to shape on a milling machine.

advantageous mainly because it is cheaper and hence better suited, from a stand point of expense, to larger shapes. How the rubber ejectors are made and fastened in place is shown at E.

With dies of this kind, leather, paper, thin hard fiber, asbestos, and other soft materials may be cut as well as sheet lead, thin copper, brass, and aluminum. Even tin foil and steel foil can be cut satisfactorily by this method if care is taken.

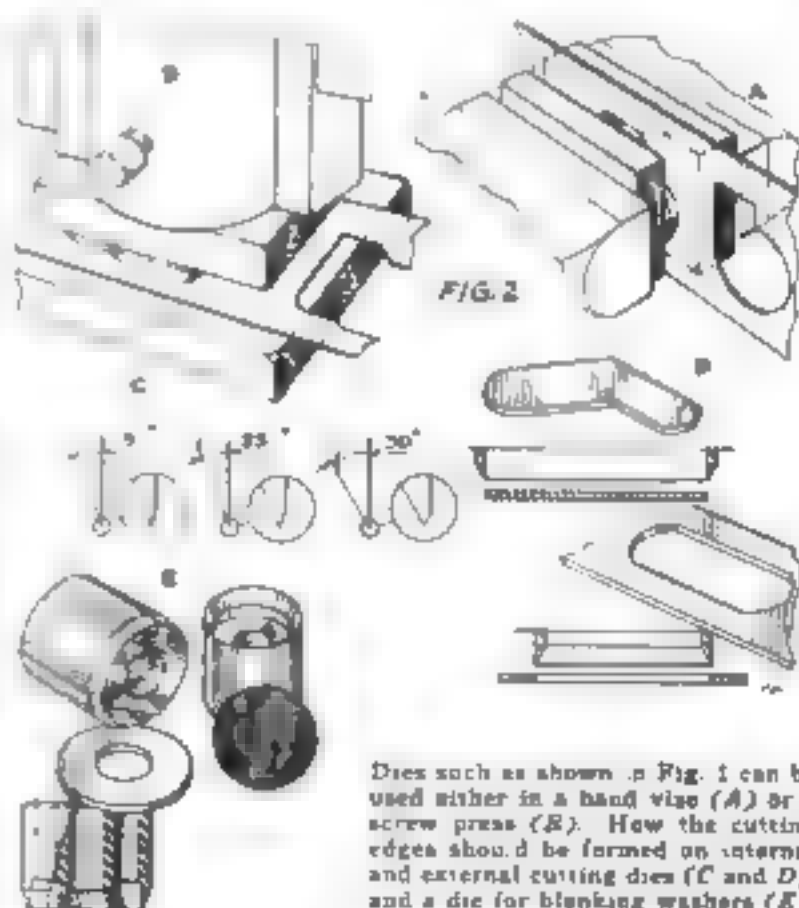
Where only a few pieces are needed, a die like that at B in Fig. 1 may be placed on the material by hand and used in a vise as at A in Fig. 2, or under a screw press as at B. For cutting very soft metals the die may be left soft, but for anything harder than copper it should be hardened and tempered to about a straw color. The pad under the material may be end-grain hardwood or thick hard fiber for any material softer than copper, and cold rolled brass or steel for harder materials requiring a hardened die.

As indicated at C the edge must be sharper for softer metals and blunter for harder ones.

Another point that must be kept in mind is to have the bevel outside for "blanking" or cutting external shapes, and to have it inside for "punching," where the material punched out is the scrap and the part with the hole is the product, as is indicated by D. In cutting small circular shapes like disks or washers, the same idea may be applied in a different form by turning a die from solid steel like those shown at E. It may be added that for leather and fiber washers, a die of this kind is far better and usually cheaper in the end than many of the rotating and frequently dangerous "washer-cutters."

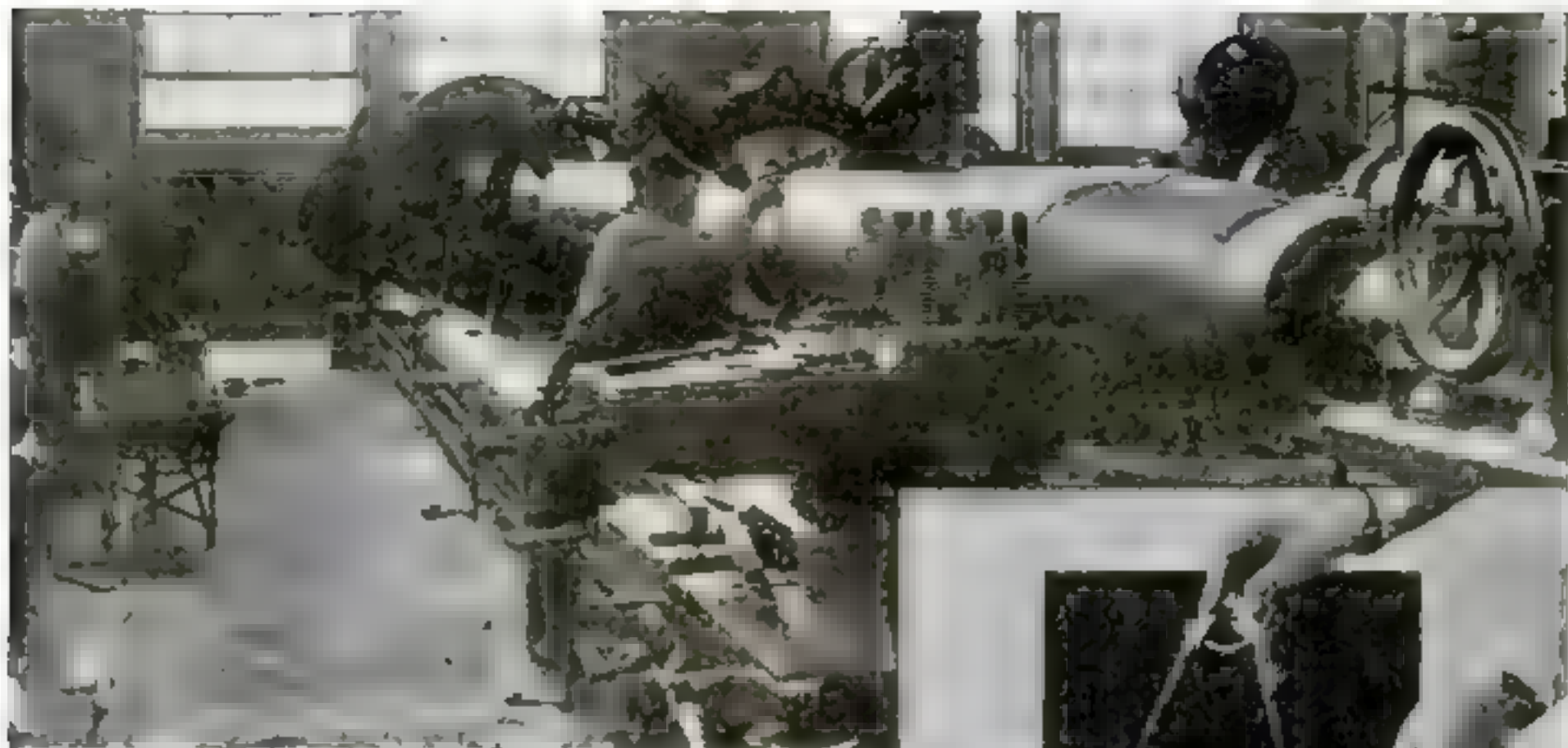
Where the material to be cut is both hard and fairly thick, it becomes necessary to find a different expedient. If only from a few pieces to a few dozen are needed, the work can be shaped by filing them between a pair of hardened templates as shown in Fig. 3. The simplest method of doing this kind of work is illustrated at A. The blanks, roughly cut and ground to shape by hand, are pinned together, or, if that is undesirable, fastened by "sweating" (soldering), as at B.

The templates are either hardened tool steel or case-hardened machine steel. By clamping the block in a vise and using alternate roughing and finishing files of different shapes and by working until the



Dies such as shown in Fig. 1 can be used either in a hand vise (A) or a screw press (B). How the cutting edges should be formed on internal and external cutting dies (C and D), and a die for blanking washers (E).





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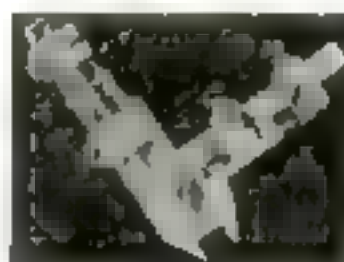
Imagine yourself running the monster lathe shown above, turning down a propeller shaft for one of Uncle Sam's new cruisers. You're about to take the finish cut. What will it be? Two thousandths? Three and a half? Five? A few thousandths too much will send those tons of steel to the scrap-heap. Do you hesitate? Not at all...you put a big Starrett Micrometer on that shaft, set the tool and calmly start your cut.

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files start to slip on the templates, the mechanic can quickly bring the blanks between them to the exact shape, as indicated at C. Metal of any thickness may be shaped by this method to a great variety of forms, of which a few examples are suggested at D. Practically the only condition is that the final shape must be such that it can be held in the vise.

Other uses and modifications of the same method are illustrated in Fig. 4. A more convenient rig for filing, and one that avoids the necessity of soldering or pinning the blanks, is illustrated at A. Each template is faced with a machine steel block b, which has a steel ball c forced into it. As shown at B, the ball revolves in a spot in a disk d, one of which is used against each vise jaw. The blanks e are held between the templates by the pressure of the vise. Partially releasing the pressure permits the entire jig to be revolved to any position for filing, after which it is locked in place again by tightening up on the vise. Quick work is possible with a jig of this kind, though care must be taken not to release the pressure too much until the parts are finished—unless, of course, they are pinned and soldered.

**WHEN** a considerable number of accurate parts from heavy material are to be made, it is often advantageous to mill them to shape with special fly-cutter tools as in Fig. 5. Though most mechanics are familiar with the use of fly cutters, such cutters are usually narrow affairs for producing a slot or small shapes. They may how-

ever, be made of considerable width and used in the place of the regular form cutters. The cutter surface speed must not exceed that of ordinary milling cutters of the same steel, and only very light cuts

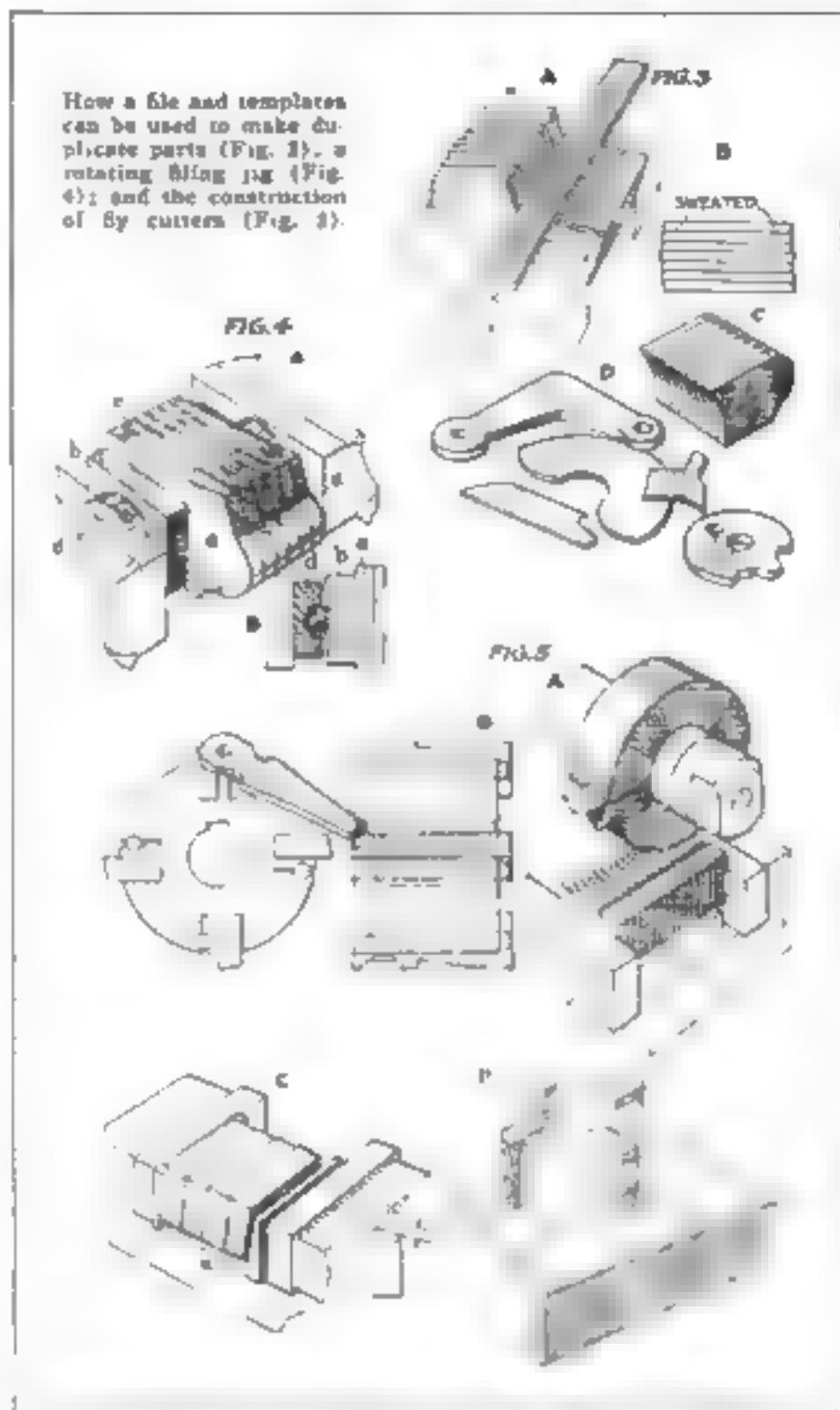
and the very slowest speed of which the machine is capable should be used. Given these conditions, it is possible to do surprisingly good work with these tools.

The simplest form of cutter head is that shown at A. This has a single cutter blade which may be "sweated" in place by soldering. That shown at B is a four-cutter head with readily removable blades. The body is made from a block of machine steel in which the blades are clamped by means of tapered pins. It must be borne in mind that the taper pin holes must be completely finished to size before they are slotted.

**HOW** to form the cutter shape is demonstrated at C. The cutter blanks are given the required shape by milling or grinding while held between angle blocks as shown, the last operation being to mill the registering edge e while the blocks are still held together. When the cutters have been finished, hardened, and tempered, they are assembled with the registering edge against a surface plate as at D. Since the same head can be used with a large variety of blades, it is cheaper to make and have on hand a large variety of different forms.

*Next month Mr. Simon will conclude this interesting discussion of simple methods for blanking sheet metal parts.*

**WHEN** filing a long, slender piece of drill rod in the lathe, use two files, one on each side of the work, and grip them together lightly at the ends. Any spring is eliminated by this method.



## Old Bill Talks Shop

**A**N EXCELLENT trammel can be made in an emergency by fitting the two clamping devices and accessories from two surface gages to a length of drill rod.

The night before is a good time to study and plan the next day's work.

Short headless cup set screws are good substitutes for transfer screws.

Always test a die shoe for squareness before mounting the die and the punch.

If you are using a lapping compound, keep your gage blocks out of the way.

When grinding in a surface grinder never allow the work to become so hot that it cannot be touched with the back of the hand.

It is best to drill and ream a hole at the same setting.

Helical end mills, or ordinary end mills not having a center, can be ground on an ordinary tool grinder by building up the cutter  $\frac{1}{4}$  in. thick on the ends with solder and centering it in a suitable collet.

When making small chisels out of drill rod, knurl them and they will be easier to handle.



## MOUNTING BLUEPRINTS WITHOUT WRINKLES

**WHEN** shop prints or other much used blueprints are to be mounted on either wall board, wood, or other mounting boards, a smooth job without wrinkles is easy to obtain by this method.

Cut the mount large enough to leave the desired margins around the print. Lay the print on the mount, line it up, and draw a few guide lines around the edge. Now give the mount a heavy coat of shellac, taking care to keep within the guide lines. Then wet the blueprint until thoroughly limp, let the excess water run off, and lay it down on the still wet shellac on the mount. Take care that it is within the guide lines previously drawn so the margins will be straight and uniform. Smooth out any wrinkles, press the print into firm contact with the mount, and set it away to dry.

When both water and shellac are dry, the blueprint will be smooth and tightly stretched.—FRANK W. FULLREADER.



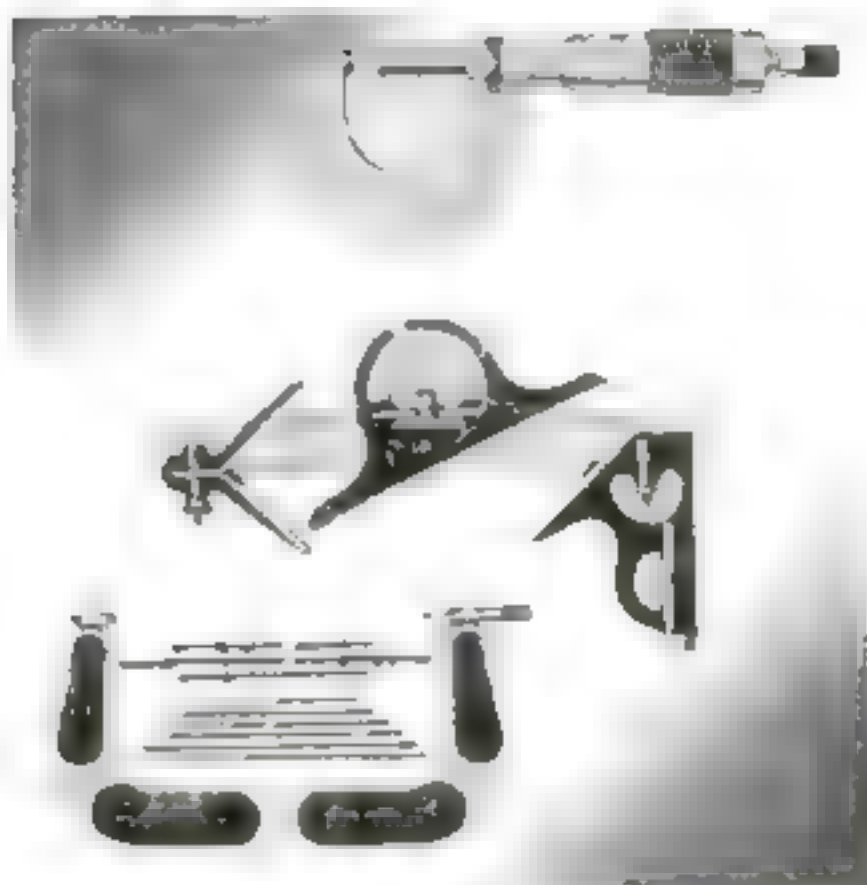
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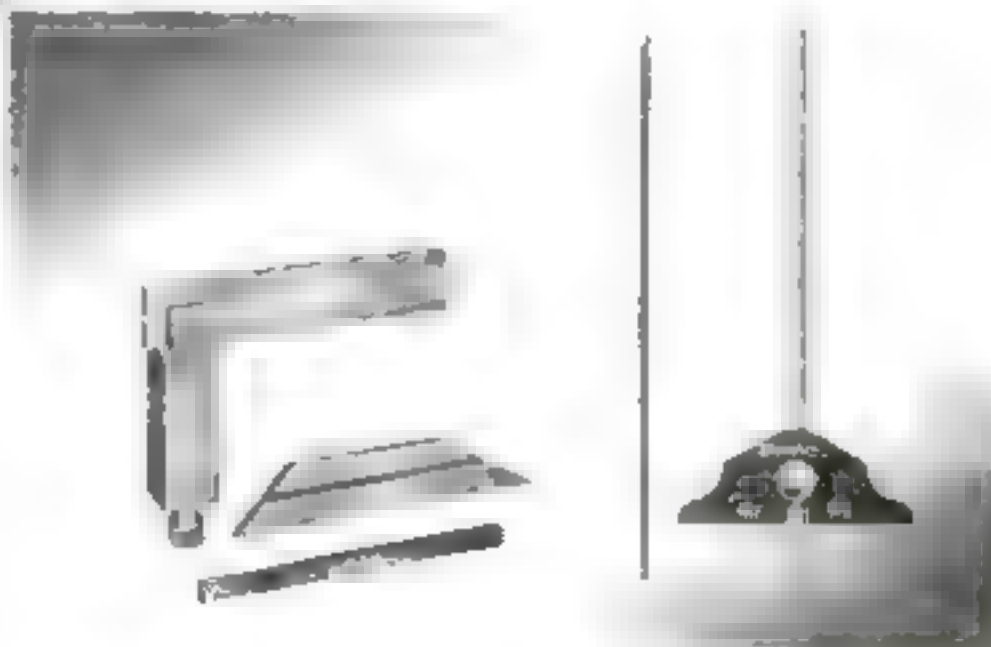
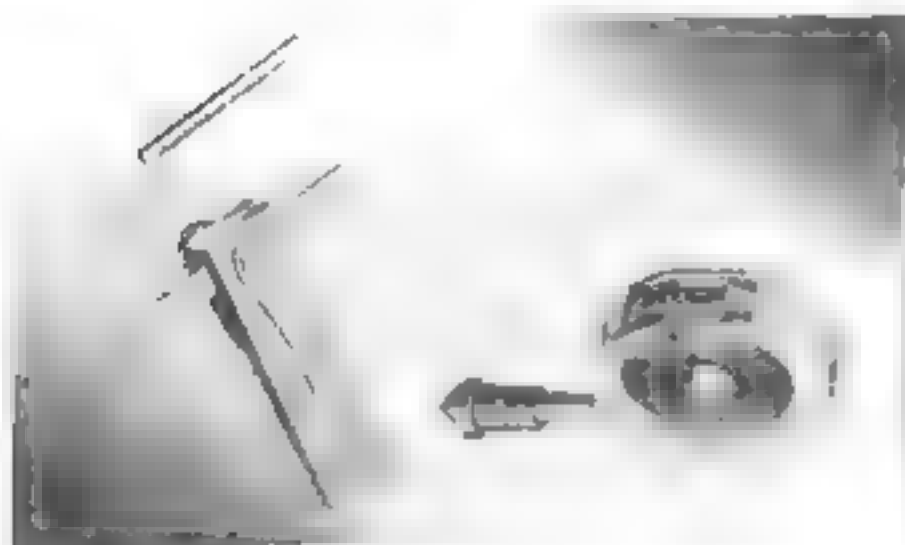
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# Five Short Cuts for Machinists

*Drilling, boring, gaging, and centering kinks, and an ingenious improvement for an ordinary V-block*

**M**ACHINISTS who are confronted with the task of drilling large holes in a number of pieces of thin metal stock will find that they can save time and turn out better work if they will make use of the following kink.

First sharpen the drill to be used according to the accompanying sketch (Fig. 1). With this drill make a conical depression in a piece of hardwood just deep enough to take the entire point of the drill, as illustrated. Next a small pilot hole is drilled in the work. The work is then centered over the depression in the wooden block, and both are held in a drill press vise.

When the drill is brought down on the work and the pressure is increased, the drill forces the metal into the depression in the wood before it starts to cut, and

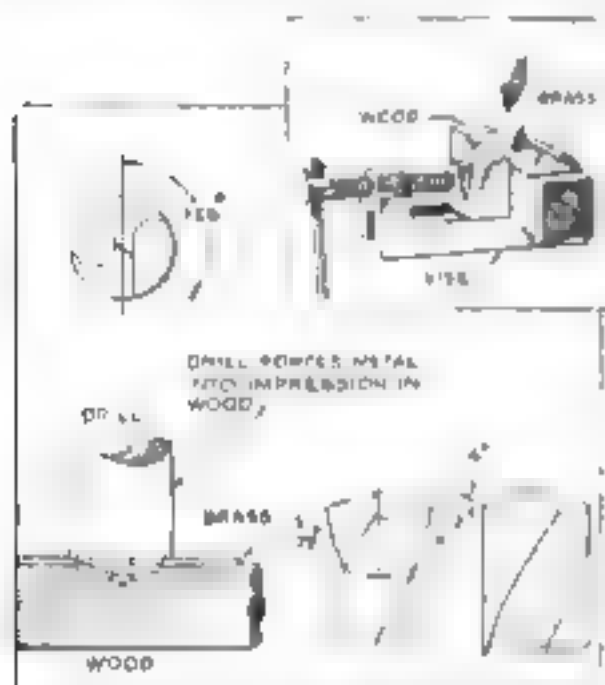


Fig. 1 A simple way to drill large holes in thin metal without distraction and chattering

thus a guide is supplied for the drill point. As the pressure is increased, the drill will cut without the usual chatter.

The writer, who has used this kink many times, has found that he has been able to drill holes that were not more than .005 in. out of round.—THOMAS COOPER

**W**HEN drilling or redrilling holes in round stock, the work can be greatly simplified if an ordinary V-block is equipped with the centering attachment as illustrated in Fig. 2. With this arrangement it is possible to set punch marks or drilled holes exactly in line with the vertical axis of the drill.

The center locating arm is made by bending a piece of strip steel as shown. This is then attached to two steel links.

When not in use, the centering attachment can be folded back out of the way by bringing the links forward in line with the block and swinging the center locating arm back until it fits snugly over the end of the V-block.—HARRY MOORE

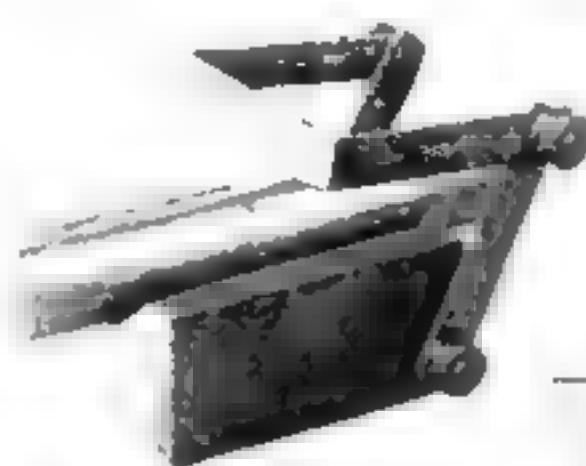


Fig. 2 V-block with centering attachment for setting work to be drilled

**W**HERE production in either the machine shop or the pattern shop requires numerous concentric circles to be laid out on disks, flanges, and similar parts, the work can be speeded up if a circle-scribing gage like that shown in Fig. 3 is used.

The head of the gage is a brass casting while the movable shank is hardwood. The shank is held in the desired position by a small wing screw.

This type of gage can be used on both internal or external curves by setting the scriber point either beyond or behind the guide feet of the gage head.—W. LUTZKYBERGER

**I**N BORING holes with a noncentric boring tool, considerable dexterity is required in moving the tool (shown at A, Fig. 4) the right amount in order to remove the last few thousandths of an inch. If a collar B with a hole out of center is placed as illustrated, the necessary delicate adjustment for removing the last few thousandths is made by turning the screw C, which causes the bor-

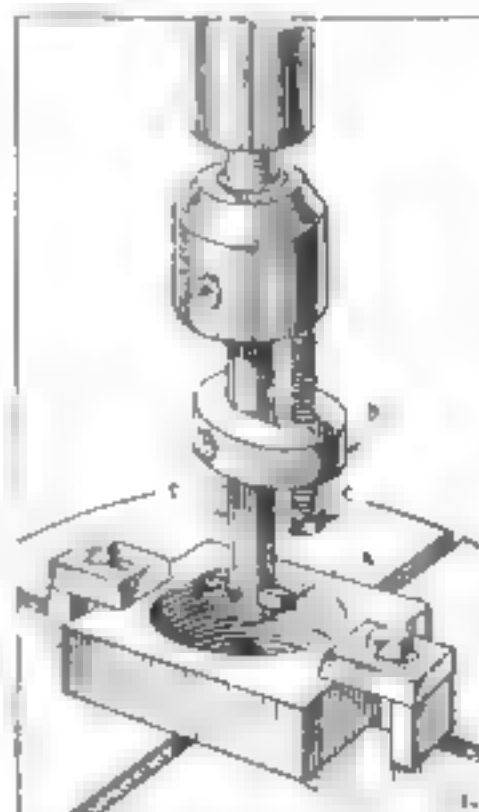


Fig. 4 A plain boring tool fitted with a screw for fine adjustment

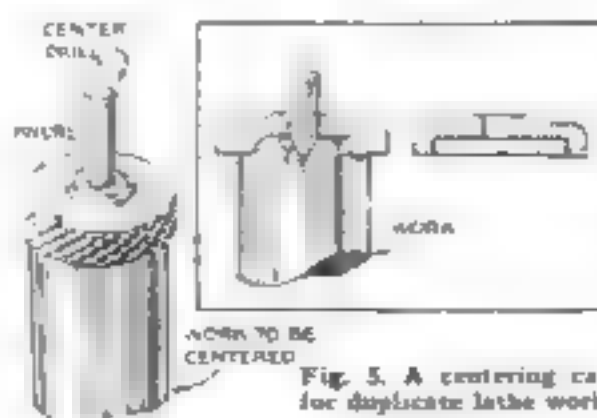


Fig. 5 A centering cap for duplicate lathe work

ing bar E to spring the necessary amount.

It will surprise any mechanic who has not tried this kink what an accurate adjustment can be obtained.—CHARLES KUGLER

**F**EELING that the usual method of centering duplicate work in the lathe was a needlessly slow and troublesome operation, the writer conceived the idea of a centering cap such as is illustrated in

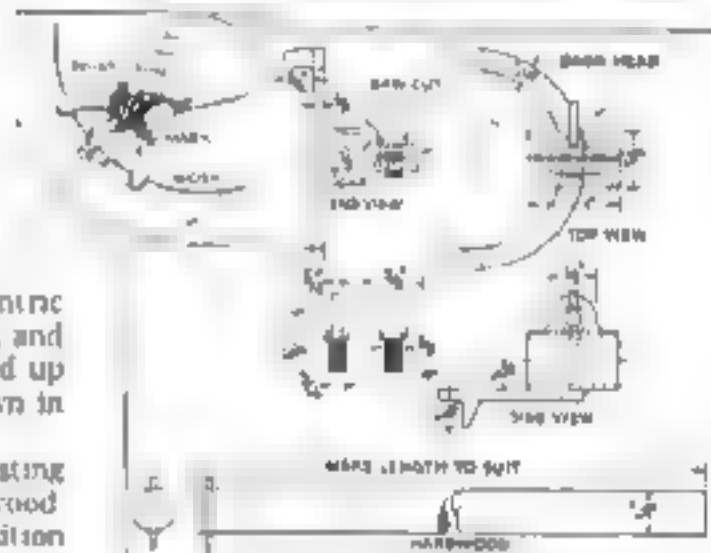


Fig. 3 An adjustable gage for scribing circular work

the drawings of Fig. 5.

With the cap in place the work is centered in the drill press and later is faced on a half center in the lathe. The center drill is automatically centered by the hole in the cap made to fit the work. This method not only saves time but also materials, since the stock can be ordered to the exact size required and not from  $\frac{1}{8}$  to  $\frac{1}{4}$  in. oversize to allow for centering. Another marked advantage is the facility with which work can be recentered if the original center becomes damaged.

Such a cap is equally useful for work that can be centered in a

lathe collet. If the cap is slipped over the end of the work in the collet, the drill will not run out.—CLARENCE J. TURCOTTE

**T**HE dust caused by dressing a grinding wheel with a diamond is exceedingly harmful if inhaled. A mechanic, during the few seconds required for dressing a wheel, should hold his breath and then quickly step back while the cloud of dust settles down, which will take only from thirty to sixty seconds.—F. GLOWZIEWSKI



Inspector L. R. Rosenberger using a **LUFKIN** Depth Gage to check work on airplane carburetor jets and dies at the Zenith Detroit Corporation.



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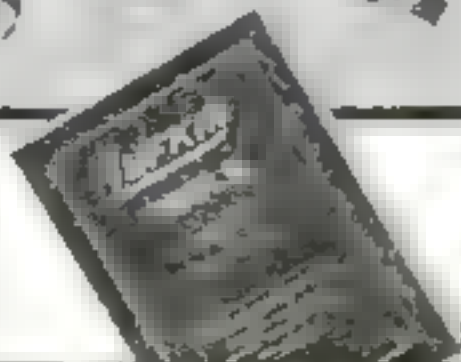
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What could be a better subject for a model than the Corsair, one of those trim little pursuit planes now used so extensively by the U. S. Navy?

## A Simplified Model of the Fighting Corsair Plane

By DONALD W. CLARK

EVERY airplane model maker has been tempted at some time or other to build a model of the Vought "Corsair" that well-designed, trim looking and speedy American fighting plane used so extensively by the Navy. A realistic yet highly simplified model of it can be made by following the accompanying drawings, which were especially prepared for POPULAR SCIENCE MONTHLY readers.

The fuselage is whittled from a block of wood  $1\frac{1}{2}$  by  $1\frac{1}{2}$  by 8 in. The nine engine cylinders are represented by cutting  $\frac{1}{4}$  in. diameter bolts into pieces  $\frac{1}{8}$  in. long and cementing them into shallow holes bored in the wood. A slot is sawed in the rear of the fuselage to receive the

vertical tail unit, as shown by the dotted line in the side view.

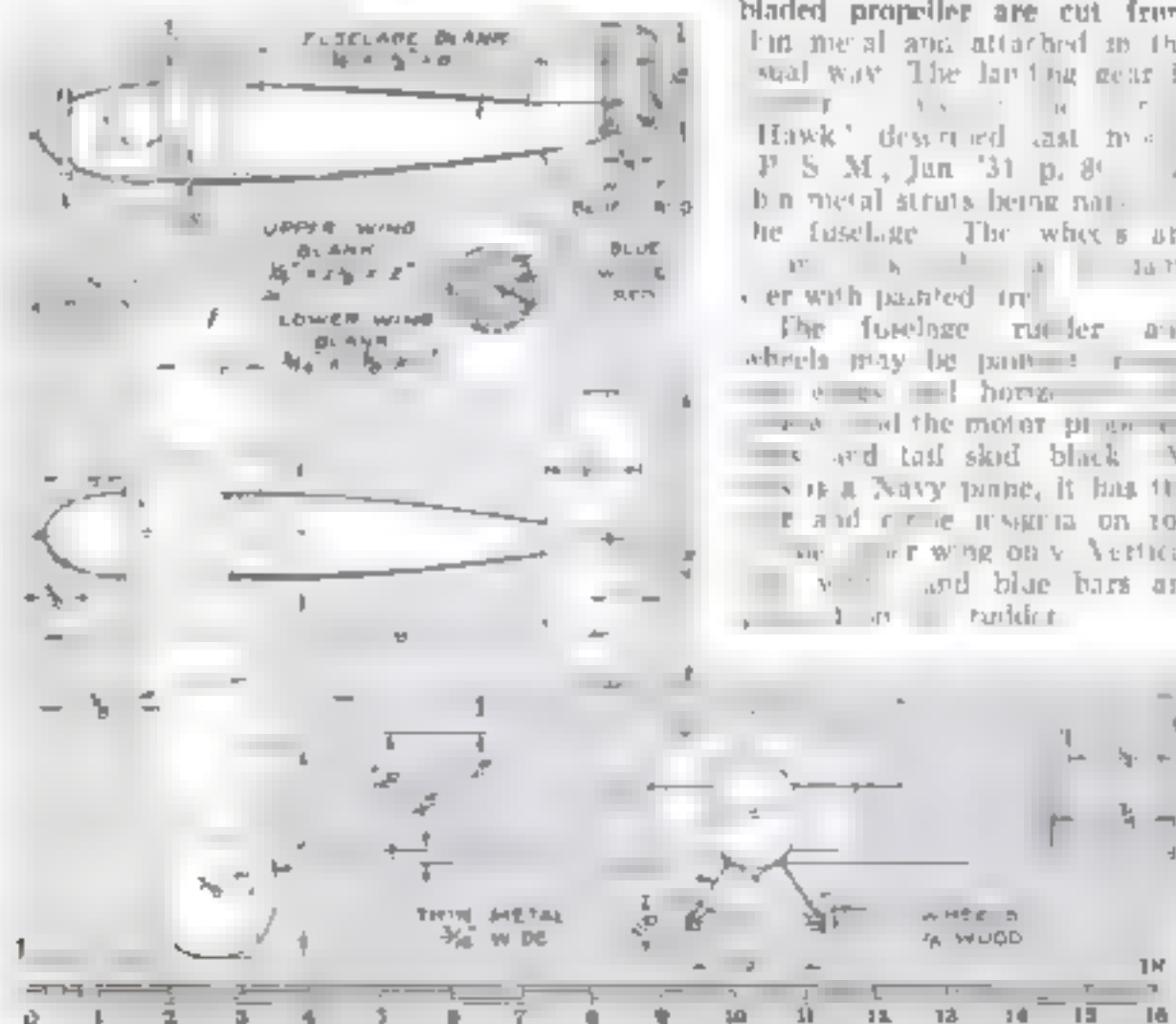
The upper wing is cut from a blank  $\frac{1}{4}$  by  $2\frac{1}{4}$  by 12 in., which is wide enough to allow for the sweepback. It is attached to the fuselage by means of six wooden struts  $\frac{1}{4}$  in. in diameter, each set into holes drilled at the correct angles into both fuselage and wing.

The lower wings are cut in one piece from a blank  $\frac{3}{16}$  by  $1\frac{1}{4}$  by 11 in. and then sawed in two. Each half is fastened to the fuselage with  $\frac{1}{8}$ -in. wire pins. Before they are attached, however, it is necessary to drill the holes for the three  $\frac{1}{8}$ -in. diameter struts on each side.

The tail unit and 3-in. diameter two-bladed propeller are cut from thin metal and attached in the usual way. The landing gear is a "Hawk" described last month in P. S. M., Jan. '31, p. 80. The main metal struts being nailed to the fuselage. The wheels are made of wood and painted black.

The fuselage, rudder and wheels may be painted in any colors and horizons.

The motor propeller and tail skid black. As it is a Navy plane, it has the "U. S. Navy" insignia on top of the upper wing on a vertical white and blue bar and a "U. S. Navy" insignia on the rudder.



Assembly views of the model and a detail showing the wing insignia. White pine or other soft wood and thin sheet metal are the only materials needed in the construction of this model.





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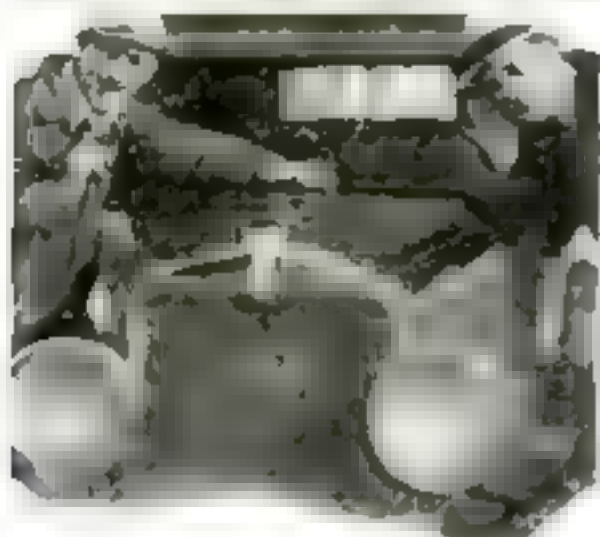
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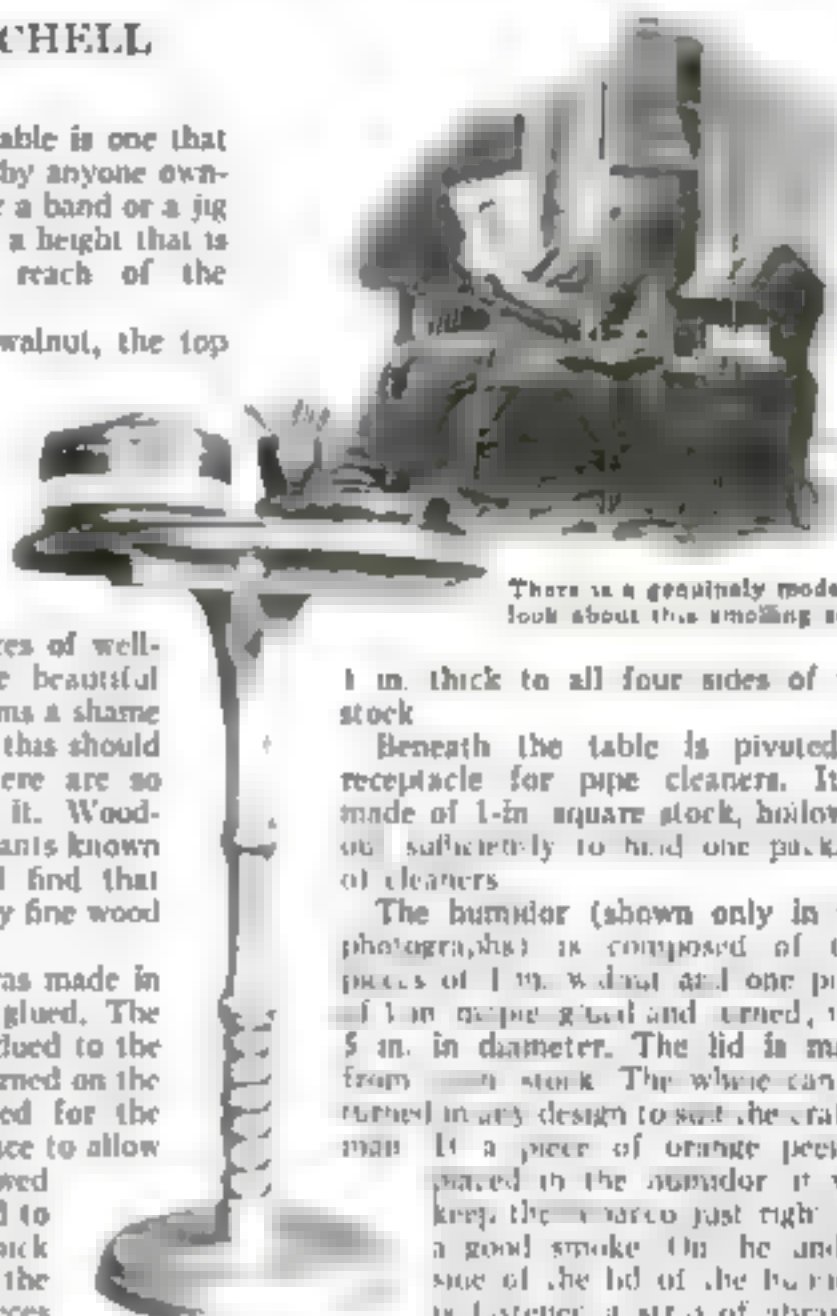
# Pipe Smokers *Will* Appreciate *This* Table

By W. E. MITCHELL

**T**HIS pipe smoker's table is one that may be easily made by anyone owning a lathe and either a band or a jig saw. It is compact and of a height that is within the comfortable reach of the smoker.

The one illustrated is walnut, the top and bottom being of wood from an old organ which was on its way to the city crematory when the writer paid an expressman a dollar to take it to his home workshop. In this organ there were many fine pieces of well-seasoned wood and three beautiful hurl walnut panels. It seems a shame that wood as beautiful as this should ever be burned when there are so many craftsmen to use it. Woodworkers who make their wares known among piano dealers will find that they can pick up some very fine wood at a low cost.

The top of the stand was made in two pieces, doweled and glued. The bottom piece had a ring glued to the underside and then was turned on the lathe. The ring was added for the purpose of providing a space to allow a piece of lead to be screwed on to steady the table and to keep it upright. The thick part of the spindle toward the top was made by gluing pieces



There is a genuinely modern look about this smoking set.

1 in. thick to all four sides of the stock.

Beneath the table is pivoted a receptacle for pipe cleaners. It is made of 1-in. square stock, hollowed out sufficiently to hold one package of cleaners.

The humidor (shown only in the photograph) is composed of two pieces of 1 in. walnut and one piece of 1 in. maple glued and turned. It is 5 in. in diameter. The lid is made from 1-in. stock. The whole can be turned in any design to suit the craftsman.

If a piece of orange peel is placed in the humidor it will keep the tobacco just right for a good smoke. On the underside of the lid of the humidor is fastened a strip of abrasive material on which to stroke the safety matches. Nothing excels a match for reliability in pipe smoking.

The ash tray, which is 4 in. in diameter, is turned from 1-in. stock. The special feature of the tray is a high center for knocking the ashes from the pipe into the tray—any pipe smoker will appreciate this convenience. The match holder can be turned from waste stock.

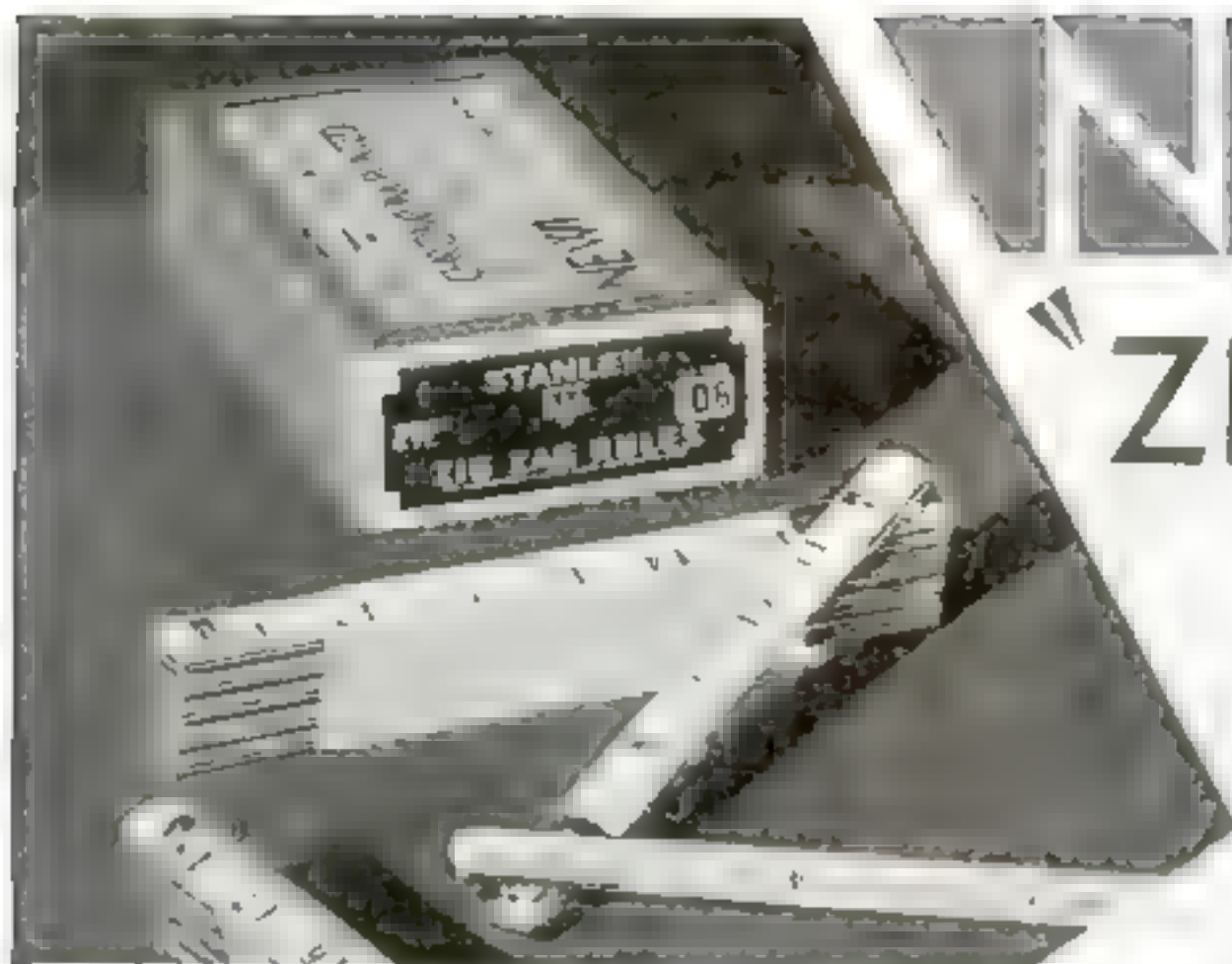
A paste wood filler and three coats of varnish were applied to the stand and the other pieces. Each coat, except the last, was sanded with a fine grained garnet paper; the last coat of varnish was rubbed with powdered pumice stone and oil.

## MAKING GROUND GLASSES

**T**HOSE who are particular about the ground glass in the focusing panel of their cameras can grind a much smoother piece than ordinarily can be purchased. Sprinkle a little very fine emery dust or other abrasive on the glass and add enough water to make a thin paste. Then do the grinding with a block of wood to which a piece of sheet copper about 3 by 5 in. has been tacked. Use circular motions and take care not to break bits of glass from the edges.—FRED H. ENGLISH

These working drawings of the table proper show clearly the originality of the design.





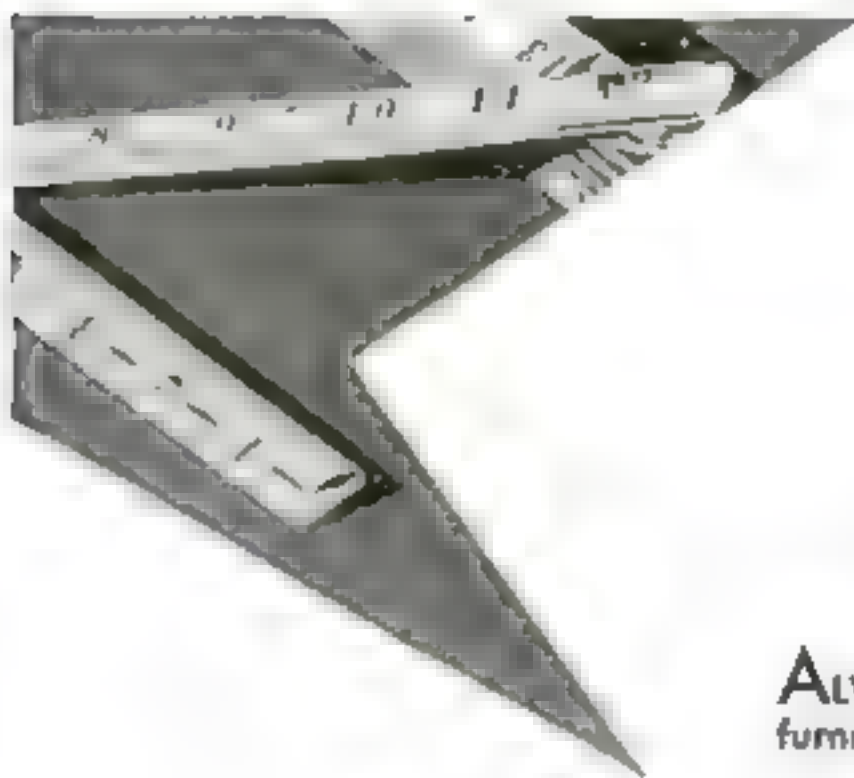
# VIEW

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New Britain, Conn.

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# STANLEY TOOLS





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Bluenose, 75c  
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Wheeler, 75c  
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Wagon, 75c  
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123-124. Queen's Sedan  
Chair 50c  
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67 Lindbergh Plane  
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73 Dolls Furniture  
101. Fire Engine,  
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Tractor  
113 Lathes, Drill Press,  
Saw, and Jointer  
114. Airplane Cockpit  
with Controls

### Abstract

- 15 Workbench  
26 Crib and Play Pen  
30 Tool Cabinet, Bor-  
ing Gage, and  
Bench Hook  
65 Six Black Purses  
128-129 11 ft Out-  
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Boat, 59c



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### "Yankee" Ratchet Screwdrivers

No. 10 Length on Flight band length  
" " " " " " " " " "  
" " " " " " " " " "  
" " " " " " " " " "  
No. 11 Same as No. 10 except May be shorter  
on one side or both

No. 12 Throat up to black area the width  
of new Red Set underneath the house  
band the distance to length = 1 x 2  
15 4 20 2 8 6 20 2 8 6

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### Abstract

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SON CO.  
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## We Finish the Deck Fittings on Our Destroyer Model

By CAPT. E. ARMITAGE McCANN

**W**ITH only a few of the deck fittings yet to be placed, our destroyer model begins to take on the trim and speedy appearance of its larger prototype, the U. S. S. *Preston*. The work of building this 31½-in. model can be simplified greatly through the use of the full size plans which appear on Blueprints Nos. 12, 126 and 127. These blueprints, together with an enlarging scale for use in building a 47½-in. sailing model can be obtained from the POPULAR SCIENCE MONTHLY Blueprint Service Department for seventy-five cents (see list, page 117).

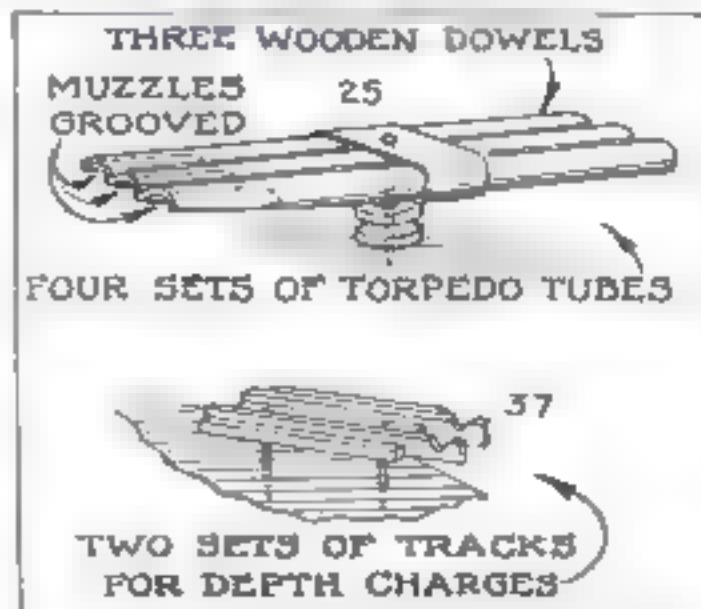
Aft the galley on the starboard side of the deck is a whaleboat. This can be hollowed out from softwood. At each end is a staple for the lowering tackle which is rigged from davits made from No. 18 brass wire lashed to the davits. Below the gunwale level of the whaleboat, is a boat spar or

strong-back. A guy starts at a staple in the galley deck, fastens the tops of the whaleboat davits, and extends to the davits for the motor-sailing launch. The whaleboat is hung by tackles consisting of two double blocks each and is held fast to the strong-back with two lines, which run from the guy between the davits to a staple in the deck under the strong-back.

On the same side of the deck is a 24-ft. motor-sailing launch 34. The davits for this and the 21-ft. dory on the opposite side of the deck are of girder-iron. I imitated these by bending a piece of square brass rod to shape. They can be fastened to the deck by filing the lower ends to a point and driving them in.

The 21-ft. dory also is hollowed from wood and has a cowl over its fore end. Nosed in, it is a 10-ft. punt 36.

With the deck in this stage of completion, it will be well to make and



Details showing the construction of the muzzles of torpedo tubes (25) and the tracks for depth charges (37).



attach the remaining ventilators as shown in the deck plan (see P.S.M., Feb. '31, p. 90)

As the destroyer is just an elaboration of the older torpedo boat, it is equipped with four sets of torpedo tubes. These I made from dowels, by beveling and hollowing the muzzle ends as shown in detail 25. The back ends are round, and a bent pin is driven into the butt of each to represent the handles on the loading breech. These dowels are glued and tightly nailed together in sets of three. Around the middle of each set, a piece of paper is glued, and a pin is driven through the center tube and used to fasten the entire set to the deck. The bases can be turned or cut from softwood.

Abaft the after deck house is a watertight hatch and a 3-in. anti-aircraft gun, which is shown in detail 32 (see P.S.M., Feb. '31, p. 92)

**R**IGHT at the stern, projecting over the edge of the deck, are two tracks 17 for the dropping of depth charges. I made the tracks, platforms, and retaining wedges from one piece of wood and set them on pins for legs.

At intervals along the edge of the deck are bollards and open and closed cleats for leading mooring lines. The former on a small model such as this, can be escutcheon pins driven in at a slight angle and the cleats may be shaped from boxwood, celluloid, or brass. For larger models, brass or white metal bollards and cleats can be cast, if desired.

Along the forward section of the deck there are six one-hal stanchions. The forward end of the rail which should be of chain, is fastened to a ring around the jack staff.

**T**HREE-BALL stanchions are used along the remaining portions of the deck excepting in the well deck and where the torpedo tubes swing out. If the deck is to be removable, a stanchion should be placed on each side of the two joints. On the original destroyer, cross lacing ran from a jacksay along the edge of the deck to the middle rail, but for the sake of simplicity—and since there will be no crew on my model to be washed overboard—I have omitted this detail, as well as the awning stanchions.

Now we have only the masts left to make. The foremast (page 121) is comprised of lowermast and topmast. Just above the bridge deck on the foremast is a band with belaying pins. This can be made from thin wire twisted to form small loops to hold the belaying pins. Just above this is a bell hung on the afterside of the mast. This can be cast from lead or filed from brass rod. Halfway up is the navigation light 43, made from two clear glass beads with a pin passed through them and riveted to a brass platform.

Higher up, and abaft, are the two man-of-war lights 44, simulated by glass beads placed on bent wires which are driven into the mast. The gall 40B has a bairdard and a signal haliard at the outer end. The cross-tree is a piece of wire drilled at the ends to take the breast stays. Three signal haliard blocks are fastened on each side of the cross-tree, for these I used very tiny beads. Silk bairdards should be rove

Character a blend of  
dignity and age marks  
the veteran pine even as  
a blend of flavory tobac-  
cos creates character  
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The work of placing the deck fittings can be greatly simplified if the model is placed in some sort of a stand. Full size drawings of this model appear on Blueprint Nos. 125, 126, and 127.

through the blocks and belayed at the mast or to the signal rat if they are signal balliards.

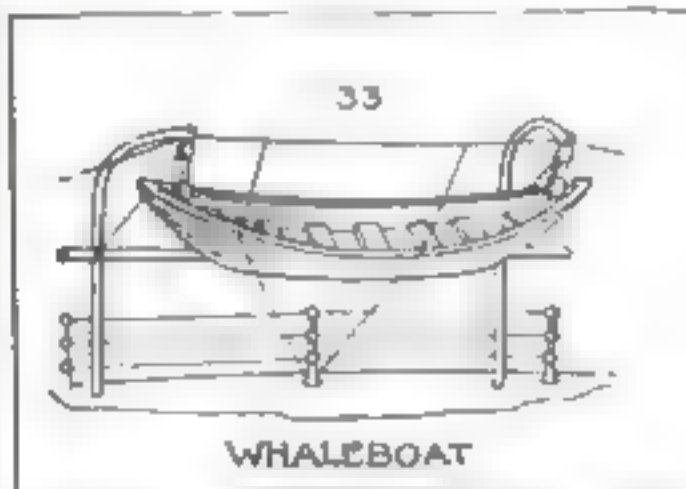
The yard near the top can be of wood. This has similar blocks, four battle lights and two blinker lights at the ends. These are very small, clear beads set on pins. Above this is a spider band with three eyes and above is another with two eyes. On the extreme top of the mast are set two

clear beads to represent a masthead light.

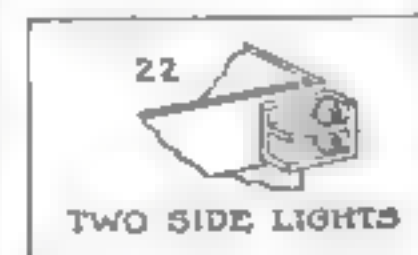
The cross-arms and cross-arms of the yard with the gear set on breechespins, the whole being fastened with brads to the mast. The cross-arms should be gouged out slightly to fit the mast, allowing the cross-arms to set upright on the trestletrees. These trestletrees I made of brass and supported with wire supports which were soldered to the trestletrees on one end and driven into the mast on the lower end.

A Jacob's ladder leads to the cross-arms. In reality this is a very high ladder made of iron bars. I made mine of thread and painted it black.

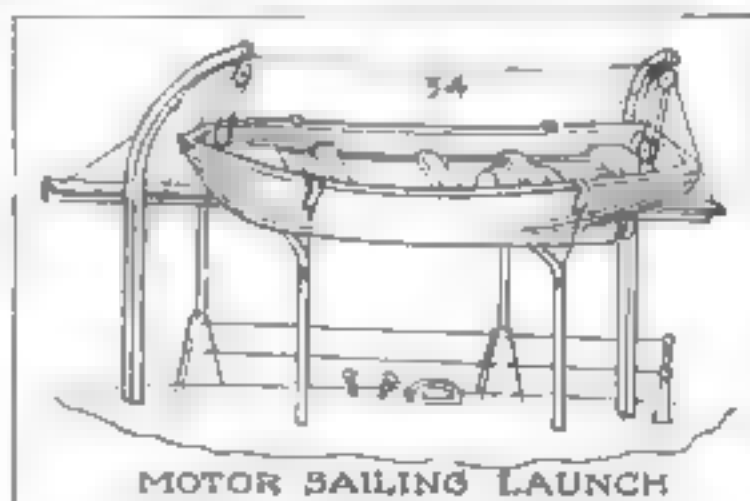
From the mast, two backstays 47 lead to the bolts in the fore-edge of the gaff. Two stays 48 lead to the masts at the bridge and two forestays 49 lead to the foredeck. There is also a longer forestay running to the bow towing post. If the deck is to be taken up, it should be covered with a look at the deck end.



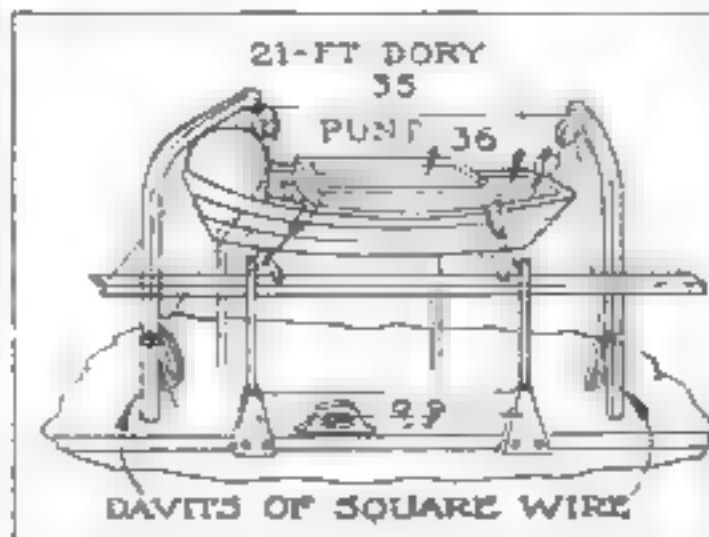
Perspective sketch of the whaleboat (33) which is placed directly astern of the gaff on the starboard side.



Red and green glass beads held in place with pins are used to simulate the pairs of side lights (22).



Sketch of the motor launch (34), which is also on the starboard side.



On the port side of the model is the dory (35) and nested in it is a punt (36). Note cleat and balliards.

so that it can be removed easily.

The after- or stub-mast on a real destroyer is hinged at the deck so that it can be lowered out of the way but on the model I fastened it in place permanently.

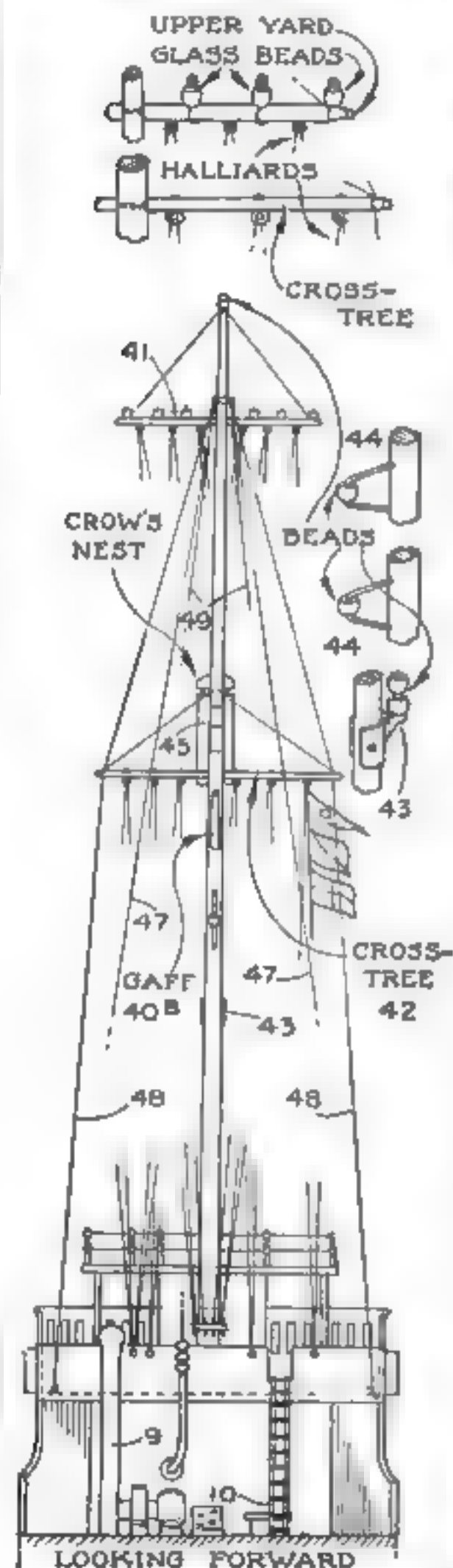
Stretched between the masts is the radio antenna made from four strands of No. 32 silk-covered magnet wire, from which the silk has been removed. These are stretched and soldered to wire bars or spreaders, which in turn are fastened by two stays to an eye at each masthead. Four glass beads are used to represent each insula-



tor. The ends of the four antenna wires at the foremast come together and are joined to a thicker wire, which continues down to a guard leading to the radio room.

The entire model should be painted a uniform gray, excepting the life rings, brass work on the navigation bridge, halliards, and antenna wires. The vessel's number, in white shaded with black, appears on both sides of bow and stern. The name *Preston* appears on the stern.

Some readers have asked for suggestions on camouflaging the model. These will be published next month.



Rear view of the foremast and well deck and details showing points in the construction.



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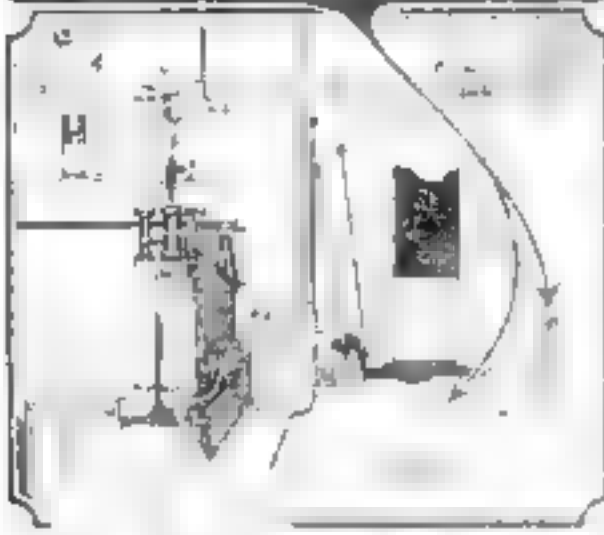
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# Ingenious Electric Fittings for the Handy Man

By HAROLD P. STRAND

SUCH electrical jobs as the handy man is called upon to do about the house can be frequently made easier if full advantage is taken of the numerous ingenious fittings which are now on the market. Professional electricians, who have all sorts of supply catalogues at their disposal, are familiar with a great many conveniences of which the amateur has never heard. Some were described in four previous articles (P.S.M., Mar. '30, p. 120; Apr. '30, p. 118; May '30, p. 122; and June '30, p. 107). Others will be described in this and in several articles scheduled to follow from time to time in forthcoming issues of this magazine.



A dimming socket in use in a wall.

What is the most convenient way to reduce the current flowing to an electric light so as to give less illumination and to control the heat of electric pads and other appliances?

By using a special dimming socket or plug. Several types are available, three of which are shown at A, B, and C in Fig. 1. A is a combination pull socket and dimmer, which is connected in exactly the same way as an ordinary electric light socket. It has two chains, one of which is pulled to dim the light and the other to increase it. The lowest point of the control dims the light to a degree suitable for a night light; at the maximum position, the lamp burns with full brilliancy.

If preferred, a socket may be obtained with a screw base to fit in the existing socket without change, the only difference being that the bulb hangs in a slightly lowered position owing to the extra socket and therefore may not be so well shaded. This supplementary socket is shown at B.

A special dimming plug is also supplied for controlling the heat of electric pads, the speed of fans, the operation of vibrators, and other uses. This plug, which is shown at C, is screwed into any light socket and the cord from the appliance is then screwed into the plug.

Can the temperature of an aquarium be fixed and maintained by electricity?

A new electric heater for this purpose is supplied in five sizes (D, Fig. 1). A thermostat which is built into the device, automatically keeps the water at a fixed degree. All current-carrying parts are insulated and shielded, and the heater comes equipped with a 6-ft. cord and plug for connection to any 110-volt supply.

What is a convenient and variable type of switch to control the small motors of the home workshop?

A new toggle-type, 20-ampere switch, combined with a pressed steel connection box, is available for this purpose (E, Fig. 1). It is a rugged, heavy-duty switch of double-pole construction and makes the control of the shop motors very easy.

What is the latest method of obtaining a candlelight effect in an electric fixture?

By the use of the electric candle lamp pictured at F, Fig. 1. It is about 7 in. long and 1 1/2 in. in diameter, with a standard Edison screw base. Luminous for its full length and giving a soft, mellow light, it is desirable for candlesticks, torches, and special fixtures where a unique candle effect is desired.

How can the theft of lamps in public halls, apartment houses and such places be prevented?

By installing one of the special lock sockets which require a key to allow the

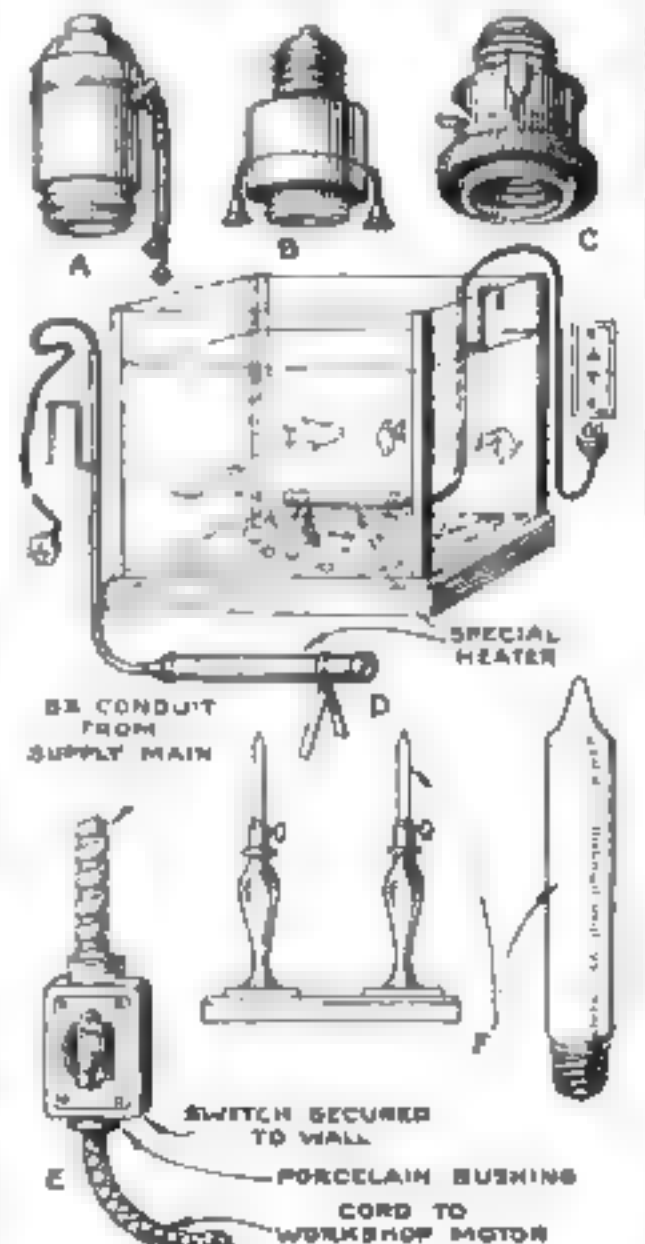


Fig. 1. Current-controlling sockets, heater for aquarium, motor switch, and candle lamps.



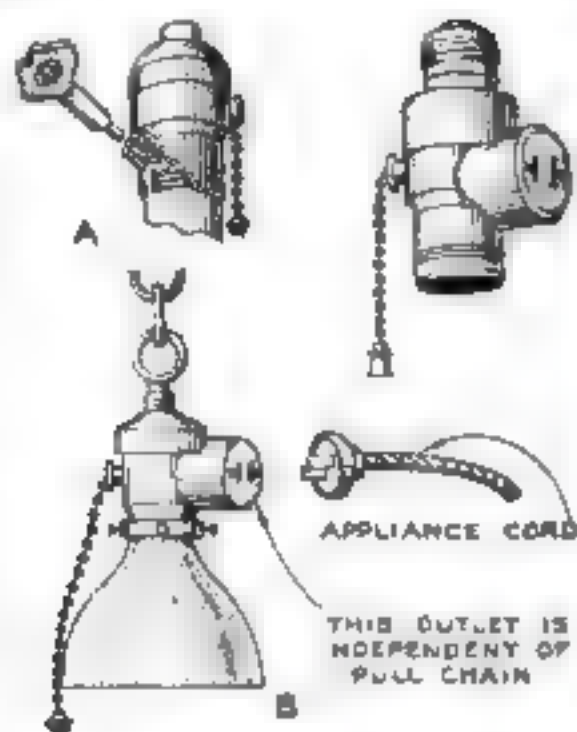


Fig. 2. A socket designed to prevent the theft of lamps, and two current tap sockets.

removal of the bulbs. Figure 2 at A shows a pull socket of this variety. It has a pointed plug that is turned into the lamp base, holding it immovable. The precaution must be taken in installing this type of socket to see that the ground or dead side of the wiring circuit is connected to the shell or outside connection of the socket, as required by the *National Electric Code*. This brings the live side up on the center contact, away from possible trouble.

*How can a cord for an appliance be connected to a fixture without using the customary two-way socket?*

There is a "current tap socket" designed for this use (B & C Fig. 2). It is substituted for the existing fixture socket. Built into its side is a plug outlet, which is independent of the pull chain which controls only the lamp in the shade. For kitchens where no iron receptacle is installed, as well as

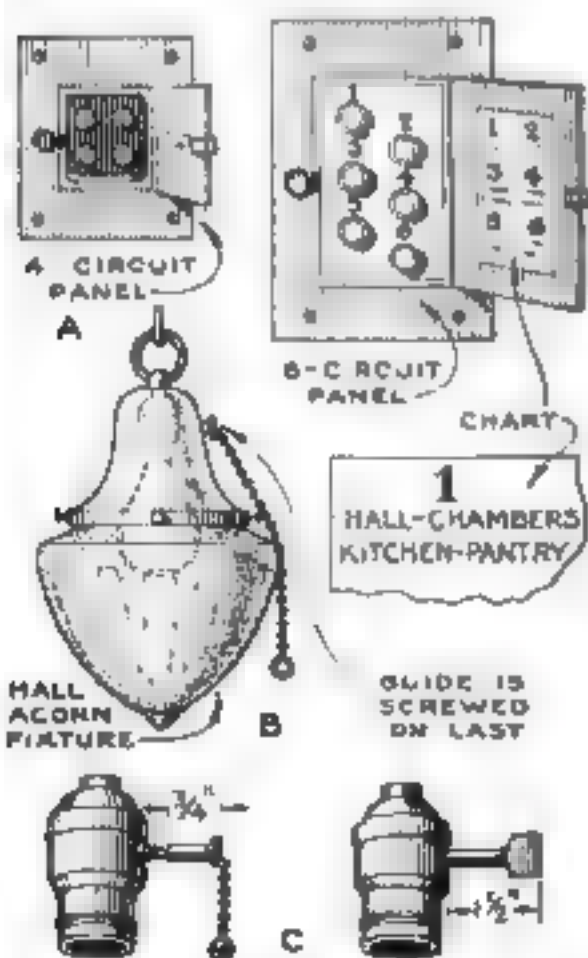


Fig. 3. Convenient ball fuse-panel boards, an extension chain guide, and a long key.



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in bedrooms or, in fact, anywhere that an attachment is needed, the socket will be found useful and practical. If one desires the same type of socket may be obtained with a screw base (also illustrated in Fig. 2) to fit in the existing socket without change.

*Where is the most convenient location to place the fuses for house circuits?*

It is now possible to obtain very compact and neatly designed flush-type fuse-panel boards, as shown at A, Fig. 3. If one of these is installed in the wall in a hall or other accessible place, the changing of fuses becomes an easy task when a blow out occurs. A chart pasted on the door on the inside, with numbers corresponding with the fuses in the panel, tells which fuse controls the circuit in question.

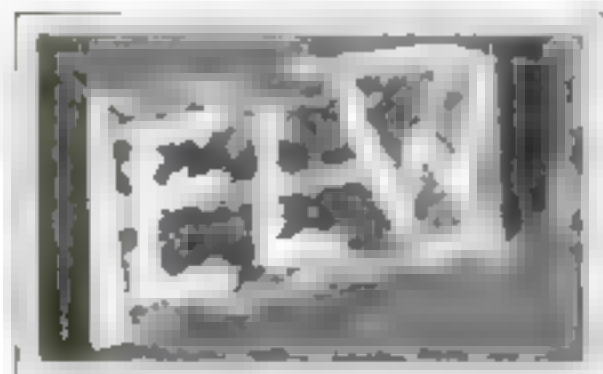
*How can the unsatisfactory operation of a pull socket be overcome when it is used with a wide socket cover like that sketched at B in Fig. 3?*

Pull-chain sockets are supplied with extra long guides (B and C, Fig. 3) to carry the bead chain out far enough to clear the edge of the cover. Such a guide allows the chain to be pulled easily and smoothly. Key sockets with extra long keys (also shown at C, Fig. 3) are obtainable for the same purpose.

## LARGE ICE CAKE MAKES NOVEL ELECTRIC SIGN

A CAKE of ice can be converted easily and inexpensively into an illuminated sign, either for advertising purposes or as a novel decoration for any evening event outdoors.

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Letters chipped on the surface of this cake of ice are illuminated by light from behind.

or more electric lamps are suspended behind the cake and shielded in such a way that the light can pass only through the ice. When the light, in passing through the ice, strikes a place where the surface has been chipped and cracked, the rays are broken up into all the colors of the spectrum—this renders the letters or design visible in an unusual and most attractive way.

This idea, like the ice mountain described last month (P. S. M. Feb. 31 p. 9) and the illuminated blossoms in the preceding issue (P. S. M., Jan. 31, p. 85), was developed by L. C. Porter, a Cleveland electrical engineer—V. B. C.

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# SMALL IRREGULAR AREAS MEASURED WITH AID OF POCKETKNIFE

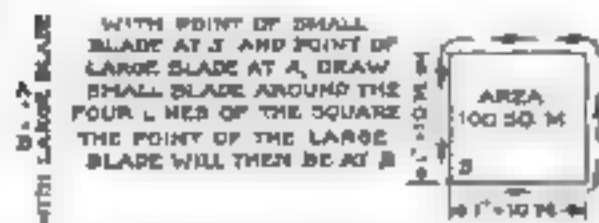


During the tracing process the large blade is allowed to slide back and forth freely

**F**OR computing the area of an irregular surface, as in the case of a lake shown on a map, the method illustrated is simple and surprisingly accurate.

First, a square of known dimensions is laid out to the scale of the area to be measured (in this instance a unit square representing 100 sq. mi.). A jackknife is next opened as shown, and the short blade is held lightly by the thumb and forefinger so that the point is against a corner of the square. The point where the large blade touches the paper is then marked. Keep the knife in an upright position and, allowing the large blade to "track" freely, move the end of the small blade around the lines of the square until the starting point is reached. The spot where the large blade now touches the paper is marked. The space between these two marks (indicated as A and B in the diagram below) is a unit which represents the area of the square.

Next, the procedure is repeated on the irregular surface. By tracing around the edge once, the distance X-O is determined. This distance is then compared to a scale of units A-B. If the distance X-O is found to be equal to two and a half times unit A-B, for example, the area of the irregular surface is two and a half times the area of the square.—H. S. RUSSELL.



DISTANCE A-B REPRESENTS AREA OF SQUARE

THIS DISTANCE REPEATED  
FORMS A SCALE AS SHOWN



REPEATING THE ABOVE DESCRIBED  
OPERATION ON THE IRREGULAR SHAPE  
GIVES DISTANCES X-O, WHICH MEASURED  
BY THE SCALE EQUALS THE AREA IN SQ. FT.

How a square of known size is used to estab-  
lish a scale for measuring an irregular area.

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The construction is of the simplest. I used a piece of mahogany 1 by 4 1/4 by 7 1/4 in. On this I drew four rectangles as shown and drilled out the bulk of the waste wood with a small auger bit. It was then a simple matter to chisel away the sides and ends.

The holder should be stained the desired shade and given two coats of varnish. Rub the first coat with fine sandpaper or pumice and water, and the second coat with pumice and oil.—R. L. GRAVES



Top and edge views of the holder. The four recesses are bored out roughly, then chiseled

## SALT REMOVES PLASTER OF PARIS FROM HANDS

HOME workers who have occasion to use plaster of Paris should know the secret of removing it from their hands—a trick I learned through observing my family doctor. When you are about to wash your hands after handling plaster of Paris, moisten them with water and sprinkle some common table salt over them. Rub the salt into your skin in the same manner as you would any kitchen cleanser. No soap is necessary, merely rub hard and briskly, using the salt freely. Then rinse your hands thoroughly and dry them.—JULES J. SIEKMAN

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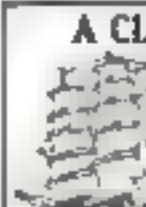
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A definite program for getting ahead financially will be found on page four of this issue.



## Double-Duty Stand for a Baby's Bassinet

By C. A. ROSELL

FOR a very small baby's bed a bassinet on wheels has several advantages. It can be moved from one room to another with the greatest ease, and for trips away from home the basket can be lifted bodily to an automobile without awakening the baby. The stand, too, is light enough to be transported in the car. Furthermore, a bassinet of this kind costs little to make



and later on the stand can be utilized, simply by adding a top, as a tea wagon or kitchen maid.

Built in the simple way shown, the stand for the basket requires few tools—a plane, saws, screw driver  $\frac{3}{8}$  in. auger bit, brace, gimlet bits or drills, and sandpaper.

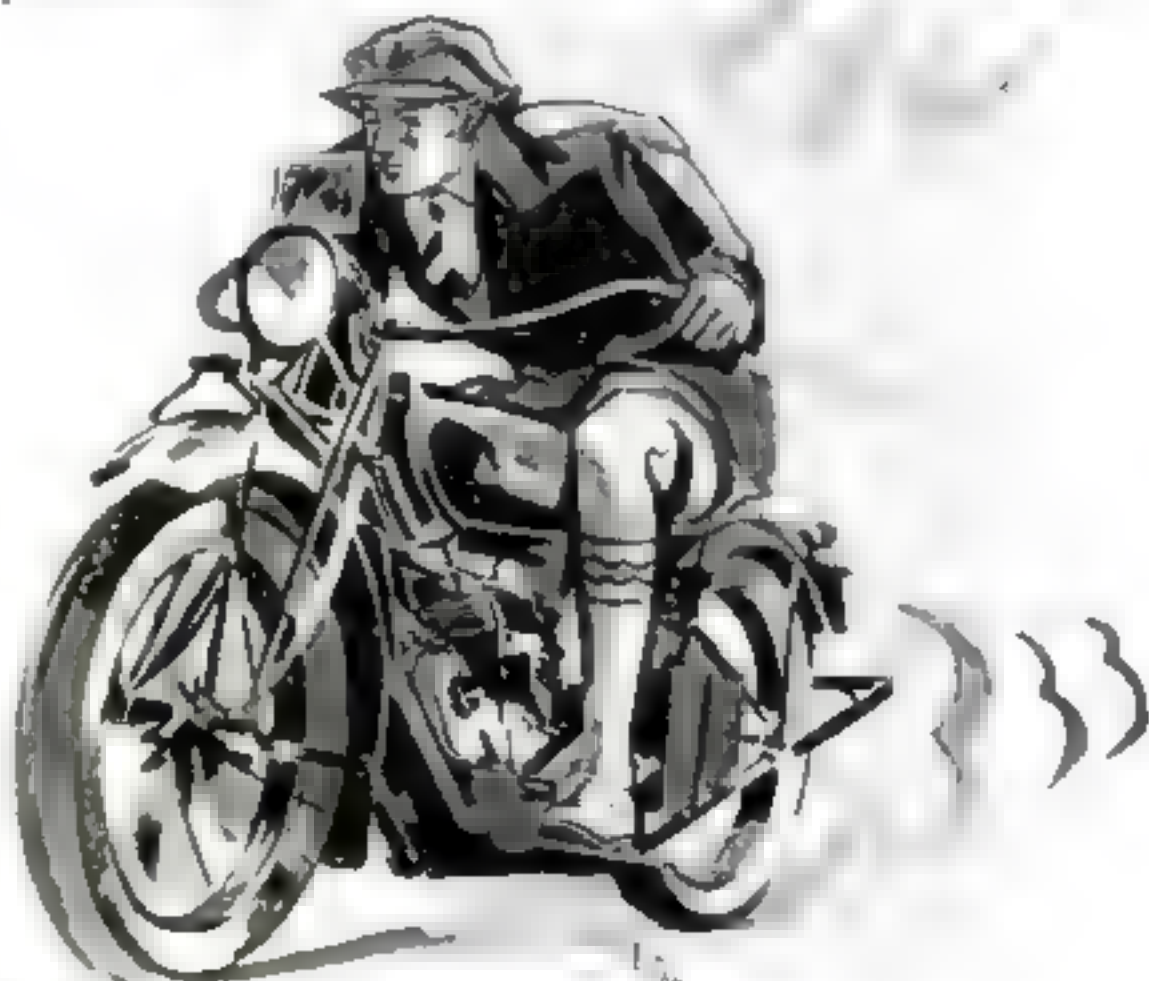
Use any wood hard enough to hold the screws in the end grain. Cut the pieces to the dimensions indicated in the accompanying bill of materials and assemble them as shown in the drawings. Cross braces may be used to stiffen the construction of the lower rails, but they were not found necessary for the stand built by the writer. Do not, however, use screws less than 2 in. long, because at best they hold only moderately well in end grain. Select high-grade ball bearing casters so the stand can be moved smoothly and guided easily.

It is obvious that the stand can be built with turned legs, if desired, and elaborated into a more ornamental piece of furniture, especially if it is to be converted into a tea wagon later on. Even in its plain form, however, it is attractive if

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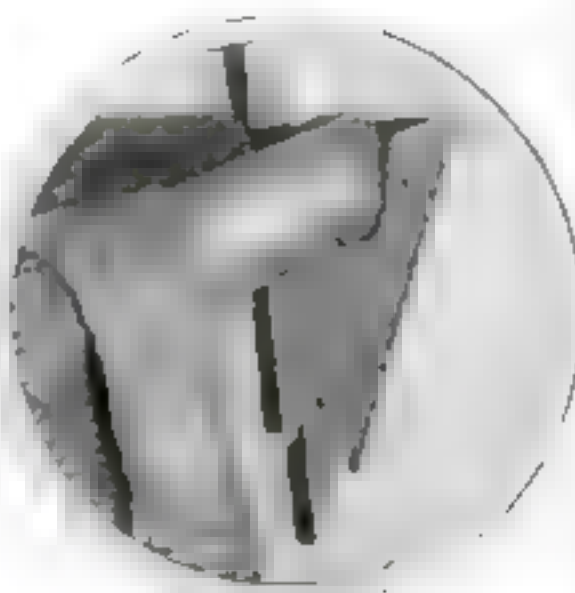
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When a band saw is available, a pair of the supports can be cut out in a minute or two.

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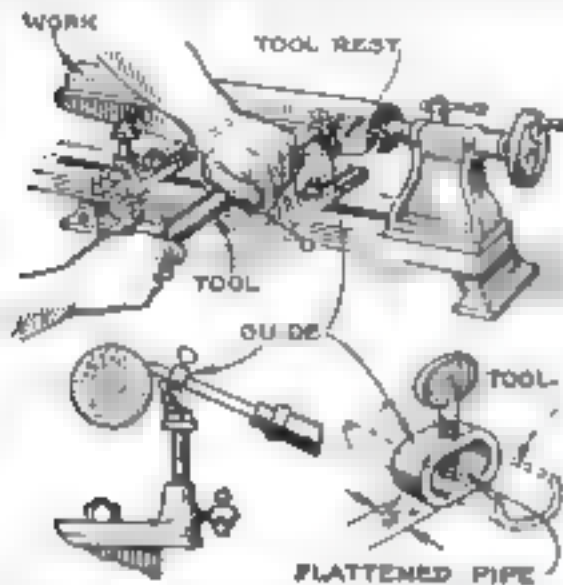
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## GUIDE AIDS IN TURNING CYLINDERS AND TAPERS

IT IS often difficult for a beginner to turn true cylinders and tapers in a wood turning lathe. The accompanying drawing shows a guiding attachment for a lathe tool, the purpose of which is to make it easy to turn cylinders and tapers.

The guide may be made of pipe. Select a size of pipe slightly smaller than will admit the tool, and, after sawing off a section  $\frac{1}{2}$  in. long, flatten it until the tool will slip through easily. Then drill and

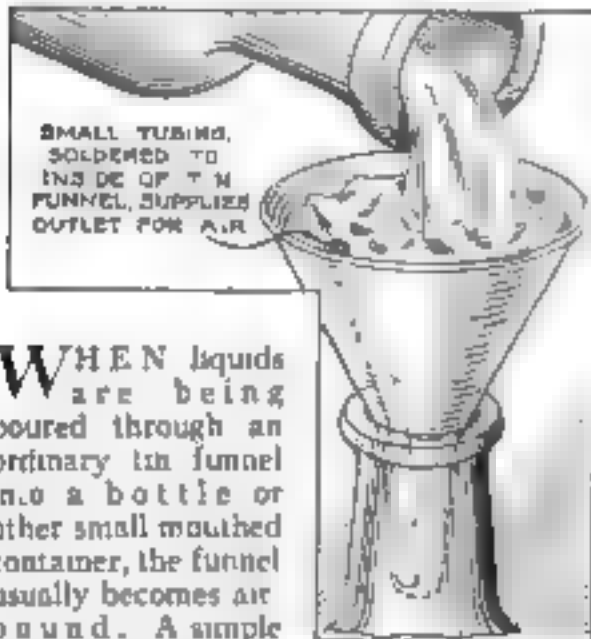


This wood turning guide clamps on the tool rest and slides like a gage along the tool rest.

tap the section of pipe for a thumbcrew. Flattening the pipe is necessary because it permits the use of an ordinary thumb-screw, which has a rather short thread. A stove nut or a machine bolt also could be used, but a thumbcrew is more convenient to adjust.

To use this device in turning tapers, first turn a cylinder slightly larger in diameter than the largest diameter of the taper; then set the tool rest at the angle with the stock which corresponds with the taper desired, and proceed with the turning. Remove a little at a time from the work until the guide slides along the tool rest.—JOSEPH J. LEKOWITZ

## TUBING SERVES AS AIR VENT FOR FUNNEL



WHEN liquids are being poured through an ordinary tin funnel into a bottle or other small mouthed container, the funnel usually becomes air bound. A simple remedy for this always annoying difficulty is to bend a length of small brass or copper tubing so that it will fit inside the funnel, as shown, and solder it in place.—JOHN B. ROSWICK.



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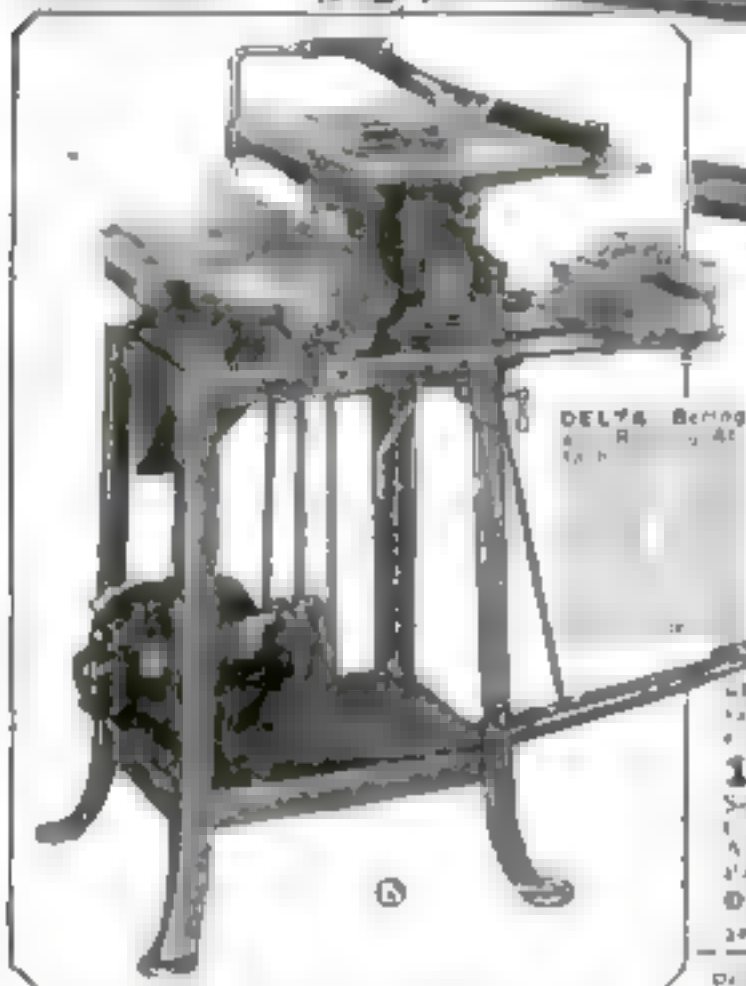
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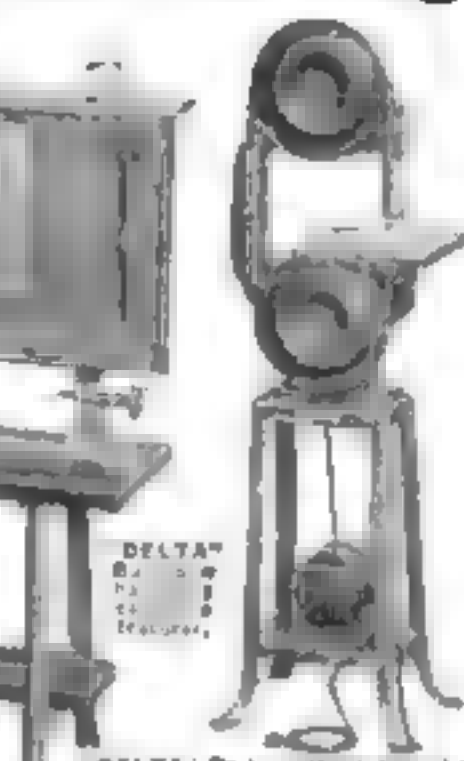
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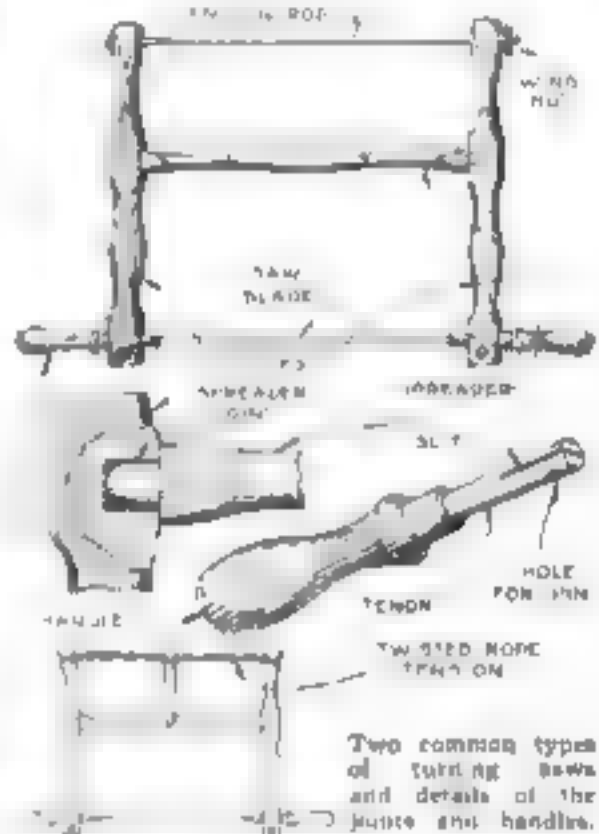
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## The Turning Saw—So Old It's Now a Novelty

FOR cutting curves and irregular shapes by hand in wood, there is one inexpensive old saw which has many special advantages, yet relatively few home workers are familiar with it or own one. It is the turning saw (sometimes called a web or bow saw). In shape it resembles the hucksaw, but it has the advantage of a narrow blade which can be set at any angle to the frame. The turning saw serves effectively where it is impossible to use either the hand, compass, or fret saw.

The blade on a turning saw is not resharpened but is replaced by a new one when it becomes too dull for use. The



Two common types of turning saws and details of the joints and handles.

blades, however, are exceedingly hard and will give many hours of use.

The size of a turning saw is determined by the length of its blade, the common sizes being 14, 18, 20, and 24 in. The range of price is generally from \$1.50 to \$2.50 for the frame and one blade. The blades are sold in 24- and 35-in. widths and can be obtained for from about \$5 to \$10 a dozen, depending on the length desired.

As a general rule the blade is inserted in the frame with the teeth pointing away from the operator, so that the saw cuts on the push stroke. In using the saw clamp the work edge up in a vise, hold the saw in one hand, bracing it with the other if necessary, and use slow, long, easy strokes, always keeping the saw blade at right angles to the surface of the work. In making sharp turns, run the blade up and down in the same place for a few strokes and at the same time turn the saw slowly until the proper direction is obtained. Avoid quick turns, as they tend to bend the blade and will often break it.

For those who wish to make their own turning saw frame, the use of either birch, maple, or ash is suggested for the stiles (sidepieces), spreader, and handles. For



Good and Good for You.



A definite program for getting ahead financially will be found on page four of this issue.

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a saw having a 14-in. blade the end stiles may be 12 in. long,  $1\frac{1}{2}$  in. wide at the bottom tapering to  $\frac{3}{8}$  in. at the top, and  $\frac{1}{4}$  in. thick. The blade is attached to the wide end. The spreader bar,  $\frac{3}{4}$  in. square, which acts as a pivot for the end stiles, is fitted to these stiles with mortise and tenon joints and is located 8 in. above the saw blade. In the best construction, the tenons are short stubs and are rounded on the ends to allow a slight pivoting action, and, of course, are not glued.

The tension rod, which pulls the smaller ends of the stiles together and thus supplies the necessary tension to the blade, can be a long bolt or it may be made from a piece of steel rod threaded to receive wing nuts at both ends.

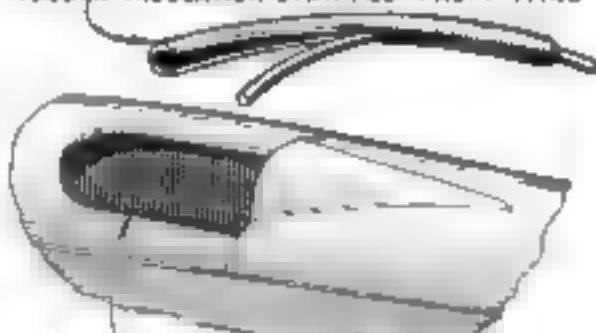
In making the handles, stock must be allowed for the round tenons which fit into holes at the lower end of each stile. A saw cut is placed at the end of each tenon and a small hole is bored perpendicularly to this slot and  $\frac{1}{2}$  in. from the end. These slots and holes take the saw blades and pins respectively.

The stiles are sloped in the direction of the saw for a distance of 1 in. above the handle holes. Holes are bored at right angles to the stiles, and bolts to take wing nuts are passed through. These slots and wing nuts serve to regulate the friction on the handles.

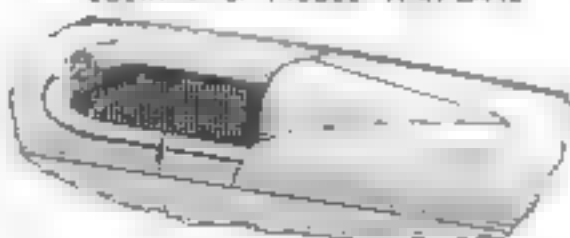
Some turning saws are supplied with a twist cord and stick instead of the steel tension rod and wing nuts. With this method the tension is applied to the blade by twisting the cord and locking it in position by means of the twist stick which is placed so as to bear against the spreader bar.—S. S. PARKINSON.

## PROVIDING ARM RESTS FOR MODEL PLANES

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# How To SHARPEN

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**F**ASTEN a Carborundum Brand Stone in the vice. Hold plane-iron in both hands, and move it backward and forward a half-dozen times, putting pressure mainly on the forward strokes. Tilt the iron at a low angle when starting, then raise gradually until bevel lies flat on stone. Move iron slightly from side to side with each stroke. Then lay plane-iron flat on stone and draw obliquely toward you to "set" your wire edge. Finish off by repeating above movements, but lighter and fewer strokes.

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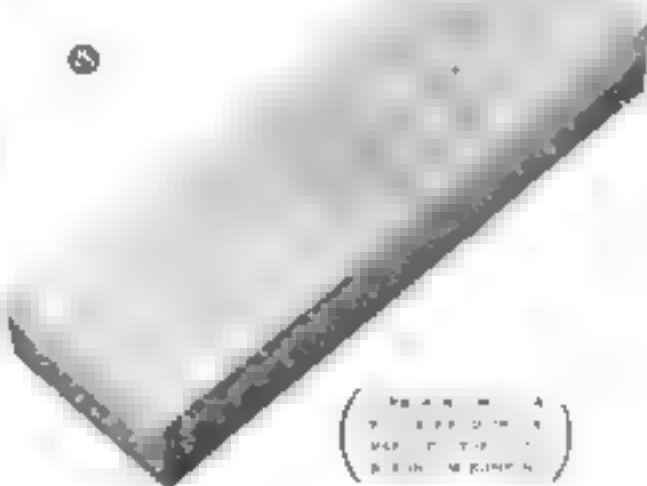
**I**N this advertisement we have had to condense our instructions. However this booklet devotes nine pages and six illustrations to squaring, grinding and sharpening plane-irons. Everything given in most particular detail.

A man who loves tools and does marvelous work with them planned and wrote this book for us—Emanuel E. Erickson. He knows the problems of all home-craftsmen, because he has had to face them and solve them. In this booklet he has very kindly and conscientiously passed his knowledge of experience along to others.



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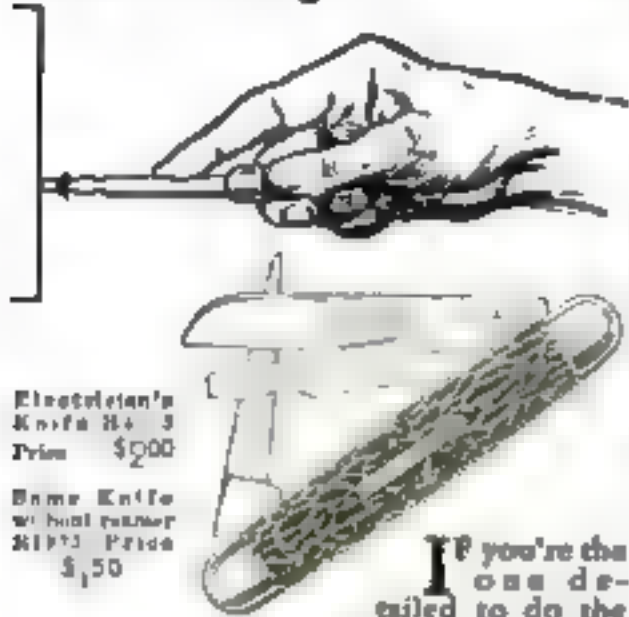
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## UNIQUE STAND IMPROVES APPEARANCE OF SHIP MODEL IN BOTTLE

RECENTLY the writer had to design a stand for a ship model in a bottle which would raise a mere curiosity to the dignity of a real decoration. The problem was solved by making the stand as



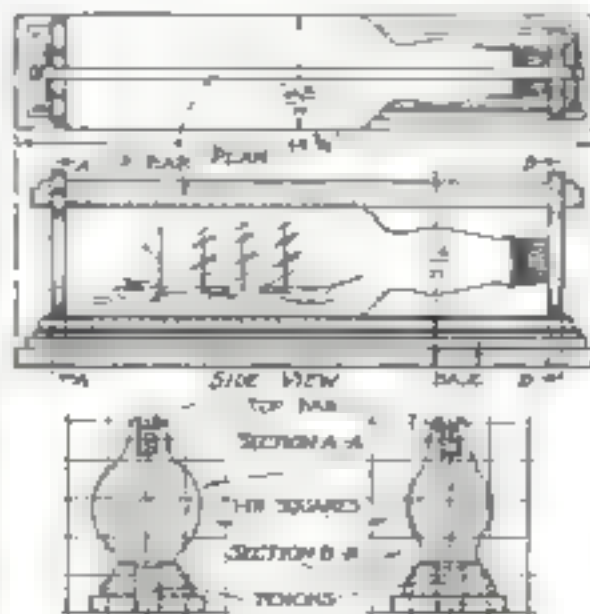
This stand avoids the common defect of giving the neck of the bottle undue prominence.

shown in the accompanying illustrations. Although the bottle is held securely, it can be rotated or removed by taking out two screws.

The molding shown is a waste piece of foot or bed molding. The profile of the sides was repeated at the ends by hand. Of course, any kind of molding of suitable size may be used; or two plain pieces of wood, one smaller than the other, may be glued on top of the  $\frac{1}{2}$ -in. base.

The ends of the stand, which conform to the size and shape of the bottle, are fastened to the base with mortise and tenon joints. The top bar is slightly hollowed out on the underside to fit the bottle, and the base is hollowed out on top in a similar manner. After being pressed down on the bottle, the bar is kept in place by two small roundheaded brass screws, as shown.

Any wood may be used. The stand illustrated was made entirely of white pine and finished as follows: One coat of dark mahogany oil stain, which was lightly sanded with worn No. 00 sandpaper when dry. One coat of shellac, lightly sanded after a few hours with slightly worn No. 00 sandpaper and well dusted. One coat of thin floor wax. Another coat of wax the following day. As a finishing touch, the mouth of the bottle was painted with antique bronze to hide the cork. This finish gave a rich effect, the dark frame bringing out the details of the ship model and softening the crudeness of the lines of the bottle.—GEORGE BROWN



Top and side views of the stand and two sectional views showing the shape of the ends.

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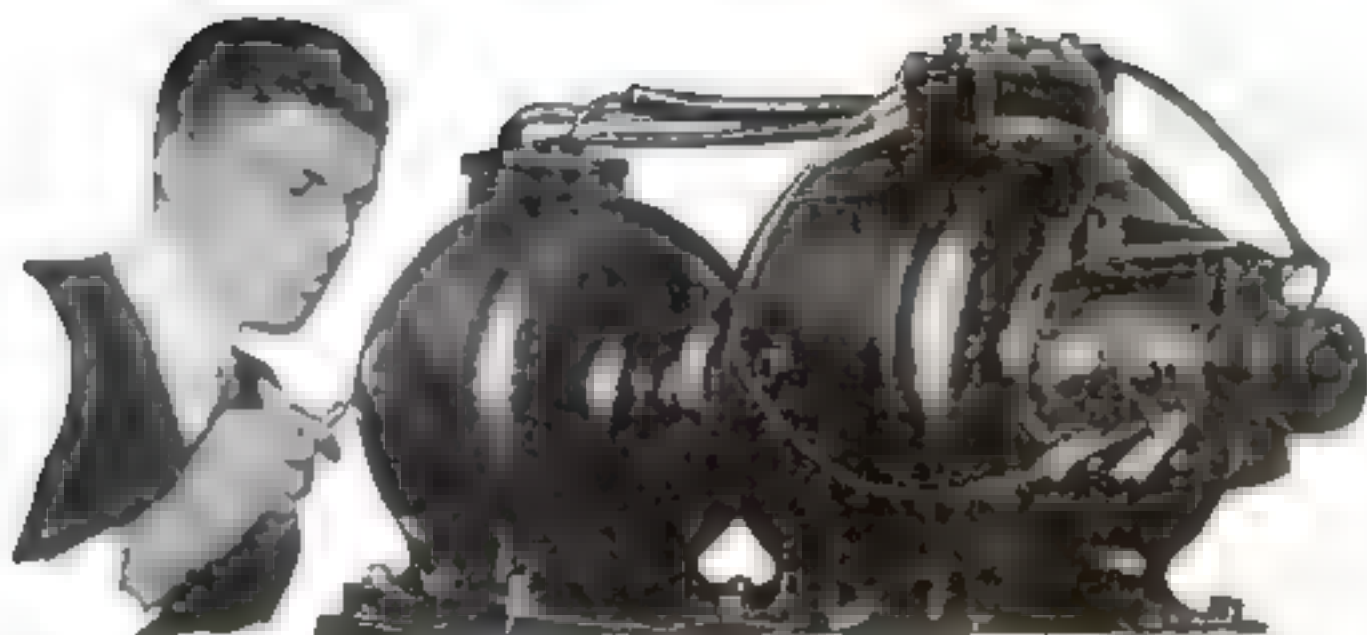
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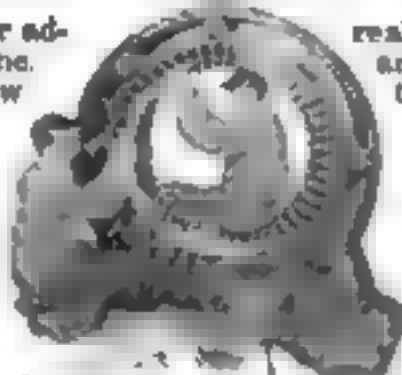
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**Figure 1**

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## WILL YOU LOSE YOUR JOB BECAUSE OF A NEW MACHINE?

(Continued from page 21)

for servicing and other tasks. It is like the spread of ripples on water when a stone is thrown into it.

Largely because of the use of labor-saving machinery, Dr. Alexander went on to explain, wages have more than doubled since 1914, the last normal pre-war year. In the same period, the purchasing power of wages has gone up forty percent. Meanwhile, the demand for manufactured goods at lower prices has so increased that twenty-seven percent of the theoretically released workmen were put back at work and an additional 1,500,000 new men were employed.

Finally, he insisted, the research and invention that led to labor-saving methods often has resulted in the creation of entirely new products or the discovery of new uses for existing articles, the manufacture of which provides jobs for many men.

Official figures show that men thrown out of work by labor-saving devices in one industry are absorbed by others. The introduction of new machinery may change a man's work but does not put him in the bread line, according to a table and chart recently compiled by the U. S. Department of Commerce.

The figures cover these labor shifts between 1910 and 1927 in agriculture, mining, manufacturing, transportation, distribution, the U. S. Government service, professional, domestic, and personal service.

They show an increase of 817,000 in the total of men and women employed. There were 2,800,000 more holding jobs in transportation, distribution, professional, and personal service, and about 2,000,000 less in agriculture, mining, manufacture and Government service.

These figures, of course, do not give any hint concerning this constant shifting and absorption process. Take, for example, the automobile industry. Every auto factory and every accessory plant had to depend on men trained and let out by other industries. In 1920, 4,700,459 men worked in automobile factories and plants supplying them with raw materials and other products, such as rubber, frames, glass, upholstery fabrics, malleable iron, steel, and the like. The total also includes those employed in the production of gasoline, in servicing, filling stations, and garages.

**B**ECAUSE it has thrown a number of so-called legitimate actors out of work the moving picture industry has been cited as an example of machinery destroying jobs. As a matter of fact, picture making has supported a huge number of men and women with work. In 1920, 200,000 men were kept busy in the industry. By 1927, that number had grown to 350,000. As a result of sound pictures from 18,000 to 25,000 more, it is estimated, have been given jobs in the past three years. Many musicians who lost their jobs through the talkies, have been given work with the radio, which also has created new jobs for hundreds of technical men.

The development of the modern hotel, apartment house, office building, and restaurant, has provided jobs for an army of men. They permanently employ engineers, steam fitters, boiler men, electricians, machinists, firemen, carpenters, painters, elevator operators and service men. In 1927, 2,025,000 men had jobs of this kind. At present, it is estimated, their number is 2,225,000.

No amount of figures, however, can wipe out the fact that the United States, even in periods of greatest prosperity, suffers from unemployment. The reason for this, in the

words of one economist, is that "technical knowledge and mechanical progress are much further advanced than is our understanding of political and social problems."

In other words, we do not know how to adjust ourselves to the machine age. Men thrown out of work by new machines, join the unemployed class until the growing industry again gives them jobs. The trouble is mechanical progress is faster than absorption. A striking instance occurred a few years ago, when the Ford Motor Company spent one hundred million dollars to change its chief product from Model T to Model A. More than half of all production machinery was scrapped, and 60,000 men were laid off. These men, and probably more, have since been taken back, but meanwhile there was a great deal of suffering.

**W**HAT is the remedy? In the old days, the workmen took matters into their own hands and sought redress by physical violence.

Unemployment insurance, private and Governmental, has been suggested. The other day, former Governor Alfred E. Smith, of New York, urged the adoption of a system of public employment agencies in the various states, cooperating with a federal exchange. Such a plan would only be possible if Governmental machinery for the gathering of unemployment statistics first were created. A bill which is now pending in Congress provides for the establishment of such a special census.

Among the first private concerns to write unemployment insurance for its men is the General Electric Company, which is trying out an experimental program calling for premiums of one percent of wages to be paid by the employees while working. Payments consist of fifty percent of wages to those entirely unemployed and of a smaller amount sufficient to make up fifty percent of normal pay to those retained on less than half time.

Organized labor's remedy, according to Frank Morrison, secretary of the American Federation of Labor, is a drastic reduction of the work day and work week and increased wages that will expand labor's purchasing power and make possible a greater diffusion of wealth.

Whatever the cure, it will not be found in doing away with labor-saving devices. Scrapping all machinery is out of the question. To return to the primitive methods that prevailed before Watt's condenser made the steam engine practicable is unthinkable. Can you discard electric lights and put tallow candles and oil lamps back in your homes?

Inventive genius can no more help inventing than a duck can help swimming. The engineer's desire to develop and apply invention to a point where it will serve mankind is a wholly normal urge that can no more be checked than the child's instinctive desire to know.

No benefit can be derived from halting progress. The present problem, as a famous economist puts it, is the result of "mankind's spiritual development failing to keep pace with the rapidly developing elements of science and technology."

This means that unemployment is not an engineering problem but one that must be solved by the economist, the sociologist, and the expert in the science of government. It is their duty to devise methods whereby progress may continue unchecked until all have an opportunity to enjoy a safer, fuller, and happier life.



### Now he **DRAWS** the things he wants

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## WHY YOUR RADIO FAILS AT KNIFE-EDGE TUNING

(Continued from page 83)

broadcast band. Some are strong, and others are weak, depending on your location and the nearness of the broadcasting stations.

Obviously, if the station you desired to hear was only one tenth or one hundredth or even one thousandth as strong at your antenna as some other station on a near-by wave, the interfering station would drown out the desired station, since both waves would go through the tuning circuit, the powerful local station only slightly reduced in strength.

ONCE you understand that the coil and condenser working together merely allow one frequency to go through unimpeded and resist the passage of other frequencies only in proportion to the difference in frequency you can see why it is necessary to use more than one tuning stage to get satisfactory results. The cumulative effect of several tuned stages, each of which pares away the strength of the unwanted signal, is needed to get the desired signal without too much interference.

Most people believe that a set for which "ten kilocycle separation" is claimed should be able to choose between stations that far apart regardless of conditions. That isn't so. The average good set today will choose between stations only ten kilocycles apart if they are received at equal strength at your antenna, but no set made will allow you to hear the weaker of two stations if the other is hundreds or thousands of times as strong. Even if the tuning circuit reduces the strength of the stronger station to a twentieth or even as little as one hundredth of its original strength, it may still be stronger than the station you are trying to hear.

The piling away of the strength of unwanted stations, which is the cumulative effect of the several tuned stages, works roughly in proportion to the difference in frequency. That is why the superheterodyne circuit is stage for stage, inherently a sharper tuning circuit than one with tuned radio-frequency amplification.

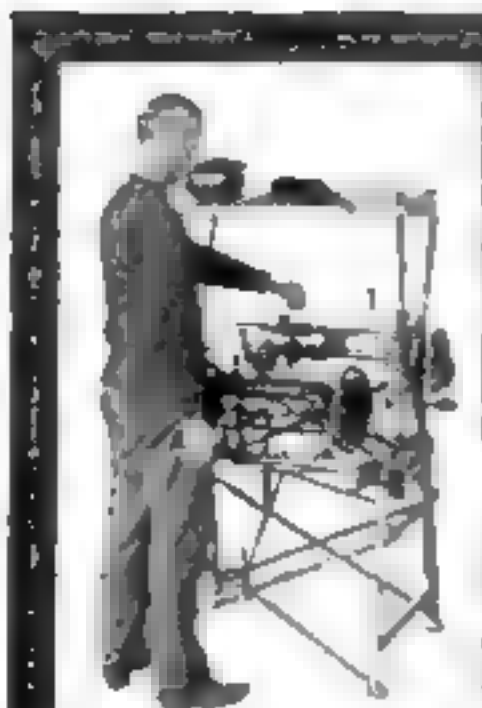
In the article explaining the operation of the superheterodyne circuit last month (P. S. M., Feb. '31, p. 84), it was shown how the "super" converts the incoming wave to a lower frequency and then amplifies at the lower frequency.

IF, FOR example, it is desired to choose between two stations ten kilocycles apart when the wanted station is operating on say 1,000 kilocycles, the difference in frequency between the wanted and unwanted stations would be only one percent.

If the same choice were to be made with a superheterodyne set using 175 kilocycles as the intermediate frequency, the difference between the two stations would still be ten kilocycles after conversion into the intermediate frequency. But ten kilocycles is nearly six percent of 175 kilocycles, and the superheterodyne would in effect be choosing between stations six times as far apart.

But the obvious theoretical advantage of the superheterodyne circuit over the tuned radio-frequency circuit is realized only to a limited extent in practice because the selective action of the intermediate frequency amplifier is not actually as great as the tuned stages of the other circuit, which operates at a much higher frequency.

The necessity of obtaining full and accurate tone quality puts a definite limit on the sharpness of tuning. If a set really had "hair-line selectivity" or "knife-edge tuning" it would respond only to a single frequency, and both speech and music would be so distorted as to be unrecognizable.



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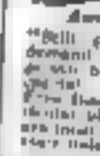
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## STARTING TRICKS FOR COLD WEATHER

(Continued from page 80)

carburetor and crank by hand. The motor will start on the second or third quarter turn. You don't have to spin it. Of course if the motor is too stiff to turn by hand, pull out the choke and let the starter grind it over two or three times so the raw gas will cut the frozen oil on the cylinder walls. Wait a minute or two till the gas has had time to act, then give it the ether. If there's anybody with you, have the party hold out the clutch pedal while you crank. That cuts out the resistance of the stiff lubricant in the gear case, which holds back the gears like so much molasses.

"Suppose you can't get any ether, then what?" Whipton asked.

"YOU'D still have a couple of tricks left up your sleeve," said Gus. "One of 'em would be to short circuit the resistance unit on the ignition coil while you get started. More current would flow and make a hotter spark, hot enough to ignite high-grade gas at zero. And by the way, if your motor is hard to start in winter, don't fool around with cheap gas. It always makes a motor harder to start than the premium stuff."

"Choking up the spark plug gap," Gus continued, "is another way to make winter starting easier. Cut the gap down to about half the regulation opening. Lots of cars are hard to start in winter for no other reason than that their owners forget the points burn away after thousands of miles of running. That makes the gap wider than it ought to be even for best summer going. That isn't the trouble with this motor, though, because I looked at the points the last time you had it in."

"Those tricks sound all right for an emergency," said Whipton, "but isn't there any thing you can do to a car that will just naturally make it easier to start without having to try tricks?"

"Sure," Gus replied. "There's a primer you can fit on the dash. Working the plunger atomizes gas in the manifold. If you add a little tank to hold extra high test gas such as they use in airplanes, or even ether if the weather is exceptionally cold, that gadget will start you instantly."

Then there's another type of primer that works electrically. It takes a minute or two to heat up the manifold. It's fine if you give your battery an extra charge now and then with a radio battery charger or if you do plenty of daylight driving.

"OF COURSE," Gus continued, "a lot depends on how you use your car. If you keep it in a heated garage and don't leave it standing in the streets more than an hour at a time, hard starting won't bother you. But if you keep it in a cold garage, the first start in the morning is going to be tough unless you do something about it."

"Some people put an electric grill or a toaster or even a big electric bulb under the hood right near the carburetor. Trouble is if you leave the current turned on all the time, it runs into a lot of money, and there's always a chance of a fire if the carburetor should leak. The red-hot wires would ignite the gas. Of course the electric light bulb is safe enough, but you have to use a big bulb, not less than a hundred-watter."

"One fellow I know sticks a drop light with a hundred-and-fifty-watt bulb in it under the hood when he puts the car away for the night, and then he throws a blanket over the radiator. The next morning, about an hour before he wants to start out, he turns on the current. His garage light is wired to a switch in the house."

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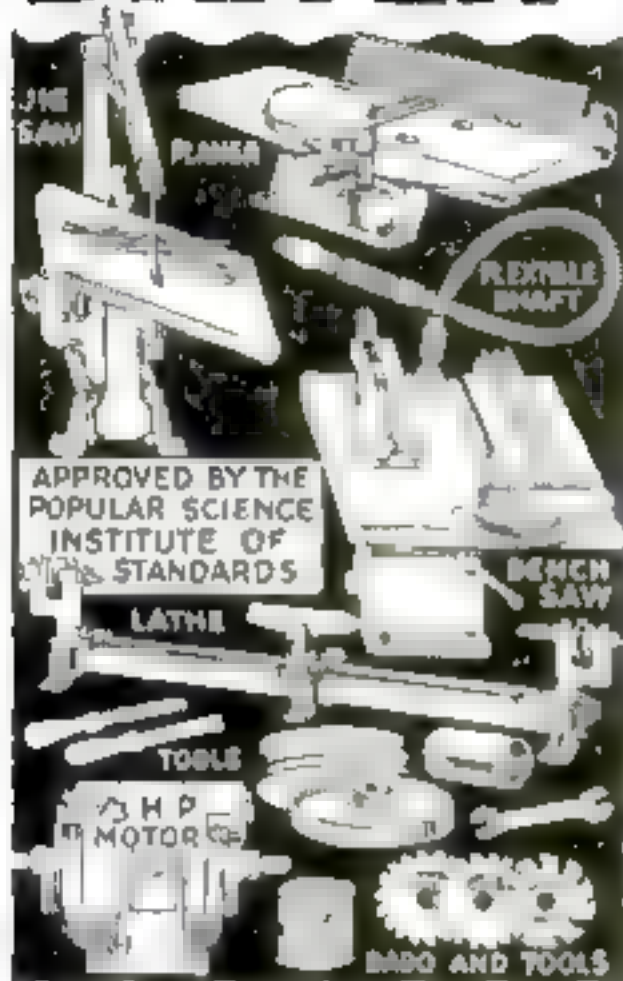
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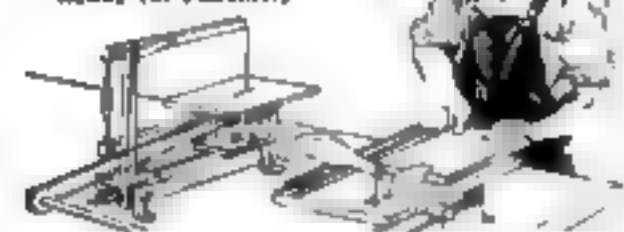


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## NAVY RIDES AIRPLANES OF DEADLY GAS

(Continued from page 31)

The color of the blood samples tested was compared with that of a series of "standard" samples previously prepared so as to present the entire range of monoxide blood poisoning, between five percent and 100 percent absorption. Thus the laboratory expert could tell at a glance whether his test sample contained carbon monoxide, and if so, how much.

The air samples were taken from airplane cockpits and cabins with a rubber bulb device. It consisted of a pint-size vacuum bottle connected with a rubber tube the neck of which contained a small quantity of soda lime, which absorbed any gas except carbon monoxide.

When the bulb was pressed a part of air was drawn in. The bottle was sealed and removed to the laboratory, where blood known to be free of carbon monoxide was added to the air. The blood then was put in a test tube and subjected to the same test as that taken from occupants of planes.

In this manner, all types of cabin planes tested were found to be free from the deadly gas. But it was shown to be present in two planes with open cockpits—one a bomber and the other an observation ship. A carbon monoxide absorption of fifteen percent was found in the blood of two occupants of the observation plane, and a ten percent absorption in that of the pilot and observer in the bomber.

These amounts are not alarming, resulting usually in a slight attack of headache or dizziness. Absorption of fifty percent is highly dangerous, causing unconsciousness or death, provided the gas has been in the blood eight minutes or more.

The Navy experts, however, considered a fifteen percent absorption sufficiently important to warrant special study, as it may result in chronic loss of muscular strength and mental alertness. For that reason, they devised the change in the direction of the exhaust leads in the two types of plane under consideration.

All the latest types of planes were tested. Experiments closely approximating actual flight conditions were conducted with bombing observation, transport, and speed ships. Cross-country hops, power dives, acrobatic evolutions, and formation maneuvers were made.

The concluding test consisted of a cross-country flight from Washington, D. C., to Lakehurst, N. J., and back in the newest type of cabin plane. The flight was made by thirteen men, including Lieut. Commander White. No poison gas was revealed in the blood of any of them at the end of the trip.

## CAR DRIVING WORDS NO LONGER ACCURATE

Are modern automotive expressions too old-fashioned? An English dictionary writer says they are, proving his point by quoting the literal meaning of certain words used. The word "drive," for example, means to "force along, hurry on, to push or propel with force." Hence a driver is one who propels with force or urges on violently.

This was an excellent word when horses and cattle were the things driven, the critic says, but it is incorrect when applied to automobiles or other self-propelled vehicles. These all push or propel themselves, all their operators do is manipulate the controls which regulate their speed or course. The French word "conducteur" the Englishman believes is a much more suitable word for indicating one who operates a self-propelled vehicle.

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## PLANTING THE SOUTH POLE IN CALIFORNIA

(Continued from page 150)

flowing through two tubes came together at the lips they formed the icy cloud. This arrangement was not foolproof, however, and the surgeon devised a new scheme.

He arranged with a Hollywood dentist to make plates of a cold resisting rubber composition to fit the upper and lower parts of the mouth. Then the actors took chunks of dry ice into their mouths. When they tried to talk with the ice and plates in place, their voices sounded muffled, as though they were nearly frozen instead of sweltering in heavy furs. And when they breathed through their mouths, the evaporating ice sent out clouds of "steam."

One actor, tiring of the plates, tried to carry the dry ice in his mouth. He emitted steam for a few minutes, but finally was carried from the set to a dental surgeon who removed four teeth. The dry ice had frozen his gums.

In building the reproduction of Admiral Byrd's Little America, mechanics first covered the ground with rough canvas and then covered this with 2,500,000 pounds of gypsum. Later, following directions on Government topographical maps, they constructed contours of "ice-covered" properties. Even the buildings were "buried" in the snow. Enough lumber to construct a town for 5,000 people went into the set. For the snowstorms, 700 tons of specially treated corn flakes, bleached to look like snow, were blown across the set by wind machines.

THE glare of the imitation ice proved more intense than the glare from South Polar ice. Five hundred pairs of sun glasses protected actors and workmen.

Huskies that had seen service with Admiral Byrd "acted" in some of the scenes. It became necessary to provide a special refrigerator in which the dogs rested. The one bit of acting required of the dogs nearly failed when the director found himself unable to coax a few howls from them. The wind machines were started, corn flakes flew all over the planes—but the dogs refused to howl. Then a property man suggested the lead dog be taken away. Immediately the rest of the pack set up a deafening howl and the camera recorded it.

Captain Parker's plane was supposed to be crashed at the South Pole by a pilot who was not aware of the lost ski. How was that filmed? A duplicate of the plane, complete in all external details, had been built. Even the light wood propellers whirled, and when hidden electric motors were started a large crane picked up the dummy until it dangled seventy-five feet above the earth. On signal, the plane was dropped on its nose. Immediately it burst into flames, aided by gasoline-soaked waste in the cabin. Eight cameras recorded the wreck.

Carpenters, with boards and canvas and gypsum, built the necessary icebergs, equipped with rollers and rockers. If the director wanted an iceberg, he had only to order one of any size, and it came rolling across a grass-covered field to the location where it would do the most good. Not only were the made-to-order icebergs wheeled here and there, but the rockers made it possible to sway them gently, thus creating the effect of slowly moving ice.

Long ago movie producers learned they could build scenes more nearly perfect than the originals. So with ice. Here they used an ice set because, during the eight weeks necessary to film various Polar scenes, they could not depend on any available mountain ice supply remaining constant in volume and shape. For pictures a scene must look the same in all episodes.

# Just as EASY as it looks

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